VOL. 82, NO. 4 DECEMBER, 1953

THE PHILIPPINE JOURNAL OF SCIENCE

MANILA
BUREAU OF PRINTING
1954

36736

2 NOV 1954

THE PHILIPPINE JOURNAL OF SCIENCE

Manuscripts intended for publication in the Philippine Journal of Science should be sent to the Editor, the Philippine Journal of Science, Institute of Science and Technology, Manila, Philippines.

Manuscripts on biology must be accompanied by abstracts for publication in the Biological Abstracts.

Fifty separates of each paper published in the Journal are furnished to the author without charge. Additional copies may be had at the author's expense if ordered when the manuscript is submitted for publication.

Publications sent in exchange for the Philippine Journal of Science should be addressed: Scientific Library, Institute of Science and Technology, Manila, Philippines.

THE PHILIPPINE
JOURNAL OF SCIENCE

VOL. 82 DECEMBER, 1953 No. 4

NEW PHILIPPINE PLANTS, II

By E. D. MERRILL
Emeritus Professor, Harvard University
and
EDUARDO QUISUMBING
Director, National Museum, Manila

FIVE PLATES

The present paper is essentially similar to its predecessor.[1] It consists largely of descriptions of nine undescribed species in various families which have been worked out from time to time after liberation of Manila, February, 1945. Fourteen species previously described by various authors from extra-Philippine material are for the first time credited to the Philippines with certainty. Following the rules of priority some nomenclatural changes are included. Unless otherwise indicated in the text, the types of the new species are deposited in the Arnold Arboretum Herbarium, Harvard University, with the isotypes in the Philippine National Herbarium in Manila.

LILIACEÆ

Genus PELIOSANTHES Andrews

PELIOSANTHES MANTEGAZZIANA Pamp.

Peliosanthes mantegazziana PAMP., Soc. Tosc. Ortic. Bull. III, 10 (1905) 50, *fig. 11; Nuovo* Giorn. Bot. Ital. II, 13 (1906) 138.

Peliosanthes teeta ANDR. var. *mantegazziana* PAMP., Nuovo Giorn. Bot. Ital. II, 11 (1904) 151.

Peliosanthes teeta ANDR. var. *angustifolia* RIDL., Straits Branch Roy. As. Soc. Jour. 59 (1911) 207; Fl. Malay Penin. 4 (1924) 323.

Peliosanthes teeta sensu RIDL., Straits Branch Roy. As. Soc. Jour. 31 (1898) 93, *cum descr.*, non Andr.

[1] Philip. Jour. Sci. 37 (1928) 133–213, *t. 1–4.*

This species occurs in southern Siam and in the Malay Peninsula. Ridley notes that he received living specimens from Tonka, Siam, in 1896, and it is very likely this lot, in cultivation at the Singapore Botanical Garden, produced the stock that has been distributed elsewhere, probably even including the living plant Pampanini had in Italy which he said was from Penang. Our concept of the species, in addition to published descriptions, is based on material cultivated at the Cementerio del Norte, Manila, *Philip. Nat. Herb. 7608 E. Quisumbing*, introduced by Mr. P. J. Wester. The species is now commonly planted in Manila, being grown in pots and in borders. This form is radically different from *Peliosanthes teeta* Andr., as illustrated by Andrews, Bot. Reg. 9 (1810) *pl. 605*, by Sims in the Bot. Mag. 32 (1810) *pl. 1302* and by Redouté, Lil. 7 (1813) 415 (text by Delile). The type of Andrews' species was from Chittagong.

CHLORANTHACEÆ

Genus SARCANDRA Gardner

SARCANDRA GLABRA (Thunb.) Nakai.

Sarcandra glabra (Thunb.) NAKAI, Fl. Sylv. Koreana 18 (1930) 17, *pl. 2;* SWAMY and BAILEY, Arnold Arb. Jour. 31 (1950) 138, *pl. 1, 2, fig. 1–21.*

Bladhia folius serratis glabris laevibus THUNB., Fl., Jap. (1784) 350.

Bladhia glabra THUNB., Linn. Soc. Trans. 2 (1794) 331.

Chloranthus brachystachys BLUME, Fl. Jav. Chloranth. (1829) 13, *pl. 2;* MERR., Enum. Philip. Fl. Pl. 2 (1923) 21.

Chloranthus glaber MAKINO, Bot. Mag. Tokyo 26 (1912) 386.

Nigrina brachystachys NAKAI, *op. cit.* 26 (1912) 386, syn.

Sarcandra Gardner was technically described as a monotypic genus in 1846. An earlier but invalid name is *Cryphæa* Buch.-Ham. (1825), non Bridel (1822), and a third generic synonym is *Saintlegeria* Cordem. (1863). *Cryphæa erecta* Buch.-Ham. (1825), *Sarcandra chloranthoides* Gardner (1846), and *Saintlegeria gracilis* Cordem. (1863) are not only congeneric but their types are conspecific. The recent critical study of a large quantity of material by Swamy clearly shows that the earlier authors were justified in separating this genus from *Chloranthus* Sw. (1787). *Sarcandra* Gardn. (1846) now consist of two species, the very widely distributed *S. glabra* (Thunb.) Nakai (Japan to southern China and Formosa, eastward to Assam, southern India and Ceylon and southward through the Philippines and Malaysia to Java and New Guinea), the other

species the very closely allied *S. hainanensis* Swamy and Bailey, op. cit. 128, known only from Hainan. The common species with which we are here concerned was originally placed by Thunberg in *Bladhia* Thunb.= *Ardisia* Sw., this being an excellent illustration of what happens when a plant species is placed by error in the wrong genus and family. The error persisted up to 1902, for Mez in his monograph of the Myrsinaceæ left both *Bladhia glabra* Thunb. = *Ardisia glabra* A. DC. as synonyms of *A. japonica* (Thunb.) Blume, where these binomials do not belong. Backer, Beknolite Fl. Jav. Chloranthaceæ 1 (1942) accepted *Chloranthus elatior* R. Br. ex Sims, Bot. Mag. 48 (1821) subpl. 2190, in nota, to replace *C. brachystachys* Blume (1828). In our judgment the brief data given by Sims do not constitute valid publication. For full synonymy see Swamy and Bailey, l. c. who list seventeen synonyms. At any rate Thunberg's name is much earlier.

Genus CHLORANTHUS Swartz

CHLORANTHUS OLDHAMII Solms.

Chloranthus oldhamii SOLMS in DC. Prodr. (1) 16 (1869) 476.
Chloranthus verticillatus MERR., Philip. Jour. Sci. § C 10 (1915) 8, Enum. 2 (1923) 22, syn. nov.

A recent collection of this is *Philip. Nat. Herb. 7869 M. Celestino* from Lubuagan, Kalinga Subprovince, Luzon. Hunan, Kiangsi, Fukien, and Kwangtung provinces in China, and in Formosa.

There are no characters by which this Philippine form can be distinguished from that of China and Formosa; Solms erred in describing the fruit as 3 cm long, 3 mm intended.

AMARANTHACEÆ

Genus GOMPHRENA Linnæus

GOMPHRENA CELOSIOIDES Mart.

Gomphrena celosioides MART., Nov. Act. Acad. Nat. Cur. 13 (1826) 301; MOQ. in DC. Prodr. (2) 13 (1849) 410; SEUB. in Mart. Fl. Bras. (1) 5 (1876) 218, *pl. 66;* HUTCH., Kew Bull. (1946) 29.

LUZON, Manila, *Philip. Nat. Herb. 5019 E. Quisumbing,* April 9,1948 "a weed, common in vacant lots," *Philip. Nat. Herb. 3758 D. R. Mendoza:* Quezon Province, Baler, *Philip. Nat. Herb. 5019 R. B. Fox.*

This species, originally described from Brazil, is widely distributed in tropical America, and in relatively recent times has become widely naturalized in various parts of the Old World, including parts of India, tropical Africa, South Africa, Java,

eastern Australia, etc. Dr. Van Steenis, Bull. Jard. Bot. Buitenz. III, 17 (1948) 402, speaks of it as a weed with "Napoleonic ambitions," which also applies to various other weeds originating in Brazil, and thinks that its occurrence in Batavia, where he found it in 1946, may have been due to its casual introduction by Indian troops in 1945. It was apparently introduced into the Philippines during the war years. In the early records of the species in India, it was confused with the allied *Celosia decumbens* Jacq., a native of Mexico.

LEGUMINOSÆ

Genus ACACIA Willdenow

ACACIA QUISUMBINGII Merrill, sp. nov. **Plate 1.**

Frutex erectus, circiter 3 m altus, ramis ramulisque spinis sparsis brevibus armatis, partibus junioribus dense molliter pubescentibus; ramis vetustioribus subteretibus, puberulis glabres centibus, lenticellatus, lenticellis brevibus, horizontalibus, ramulis junioribus dense puberulis, pallidis; foliis bipinnatis, ad 20 cm longis, petiolatis, pinnis 8-paribus, 6–8 cm longis, rhachibus dense molliter pubescentibus; foliolis circiter 40, pallidis, sessilibus vel subsessilibus, valde inaequilateralibus, rectis vel leviter falcatis, utrinque leviter pubescentibus, oblongis, 6–7 mm longis, 2 mm latis, breviter apiculatis, basi uno latere rotundatis, altero acutis, nervis primariis circiter 5, subtus distinctis; inflorescentiis lateralibus, capitulis fasciculatis et in racemis terminalibus dispositis, dense molliter pubescentibus, capitulis globosis, 8–10 mm diametro, pedunculis circiter 1.5 cm longis; floribus flavidis, confertis, sessilibus, 5 mm longis, calycibus in sicco rubro-purpureis, glabris vel obscure pubescentibus, 3 mm longis, lobis brevibus, ovatis, obtusis, vix 0.3 mm longis; filamentis numerosissimis, liberis; ovario stipitato, cylindrico, obscure pubescenti, 1 mm longo; fructibus ignotis.

LUZON, Batangas Province, Calatagan, *Philip. Nat. Herb. 6572 E. Quisumbing*, January 16, 1949, a shrub, 3 m high on open grasslands, alt. 50 m.

Although the collector's notes indicate that this is an erect shrub I have the conviction that its true alliance is with the widely distributed, scandent *Acacia concinna* (Willd.) DC. Yet from that species it differs much, especially in its indumentum. The peduncled heads may be solitary or in fascicles of threes along the upper parts of the leafy branches, the ultimate branchlets carrying racemosely arranged, usually fascicled peduncled, these, however, subtended by very small juvenile leaves; this

is also the case with *Acacia concinna* (Willd.) DC. The flowers are bright yellow even when dry.

Genus MIMOSA Linnæus

MIMOSA INVISA Mart.

Mimosa invisa MART., Flora 20 (1837) Beibl, 121; BENTH. in Mart., Fl. Bras. (2) 15 (1876) 379, *pl. 97.*

MINDANAO, Zamboanga Province, Kabasalan, *Ebalo 1005,* January, 1941. LUZON, Laguna Province, Los Baños, *Philip. Nat. Herb. 8440 M. D. Sulit,* December, 1946, in lowland rice fields.

A native of Brazil now widely distributed in tropical America. Deliberately introduced in various parts of the Malay Archipelago (Sumatra, Java), in Fiji, and now in the Philippines, as a cover crop. It will doubtless prove to be a very bad pest in waste and fallow lands, because of its habit, and its very numerous reflexed spines. Sulit says: "Introduced by the College of Agriculture as a soil improver, but now a terrible pest, found everywhere in the vicinity."

Genus ÆSCHYNOMENE Linnæus

ÆSCHYNOMENE AMERICANA Linn.

Æschynomene americana LINN., Sp. Pl. (1753) 713; FAWC. and RENDLE, Fl. Jam. (2) 4 (1920) 27, *fig. 7.*

LUZON, Quezon City, near Manila, *Philip. Nat. Herb. 5643 N. B. Mendiola,* November, 1948, *Dizon 24,* October, 1950; along roadsides; *Philip. Nat. Herb. 13855 Bureau of Plant Industry Employee:* Rizal Province, Pasig, *Philip. Nat. Herb. 4211 D. R. Mendoza:* Laguna Province, Los Baños, *Philip. Nat. Herb. 8473, 8478 M. D. Sulit.* Widely distributed in tropical America, naturalized in Java, the type from Jamaica. Probably introduced in the Philippines during the war years. Common in waste places.

Genus DESMODIUM Desvaux

DESMODIUM TORTUOSUM (Sw.) DC.

Desmodium tortuosum (Sw.) DC., Prodr. 2 (1825) 332.
Hedysarum tortuosum Sw., Prodr. Veg. Ind. Occ. (1788) 107.
Desmodium purpureum FAWC. and RENDLE, Fl. Jam. 4 (1920) 36, non Hook and Arn.

LUZON, Laguna Province, Los Baños, College of Agriculture, *Philip. Nat. Herb. 6940 M. D. Sulit,* planted (curiously labelled as from Mount Makiling, but on the field label 'Forestry Campus—an introduced plant from Hawaii.' It was sent as *Desmodium cajanifolium* (HBK.) DC. A second collection is *Leticia Dizon*

59, from the University of the Philippines Campus near Manila, in open grasslands. Thus it is evident that the species is now naturalized, and like many other introduced species of this genus quickly became naturalized once introduced. It has been confused in literature with *D. spirale* DC., and also appears in recent years as *D. purpureum* (Mill.) Fawc. and Rendle, an invalid name in *Desmodium*. Native of tropical America, now established here and there in the tropics of both hemispheres.

Genus VICIA Linnæus

VICIA SATIVA Linn.

Vicia sativa LINN., Sp. Pl. (1753) 736; BAKER in Hook., f. Fl. Brit. Ind. 2 (1876) 178.

LUZON, Mountain Province (Benguet), Mount Pulog, and Mount Pauai, *Philip. Nat. Herb. 4397 M. Celestino*, March 4, 1948, *Philip. Nat. Herb. 7502 M. D. Sulit*, January 27, 1948, alt. 200 to 2,400 m "in cultivated field, weed" and "climbing on small dead tree, near houses."

This is the first record for the genus as a Philippine one, but this Eurasian species here clearly introduced, as it is in Java. In some respects the specimens approach var. *angustifolia* Gaudin, by some authors recognized as a distinct species, *Vicia angustifolia* Roth.

Genus CALOPOGONIUM Desvaux

CALOPOGONIUM MUCUNOIDES Desv.

Calopogonium mucunoides DESV., Ann. Sci. Nat. 9 (1826) 423; AMSHOFF in Pulle, Fl. Suriname (3) 2 (1939) 196.

MINDANAO, Cotabato Province, Bugasan, Parang, *Philip. Nat. Herb. 1519 G. E. Edaño*, December 4, 1946, along streams in open forests. Native of tropical America, in recent years widely introduced here and there in the Old World (Java, Guam, southeastern China), as a cover crop, often quickly becoming naturalized.

ELÆOCARPACEÆ

Genus SLOANEA Linnæus

SLOANEA SIGUN (Blume) K. Schum.

Sloanea sigun (Blume) K. SCHUM. in Engl. and Prantl. Nat. Pflanzenfam. (6) 3 (1890) 5; KOORD. and VAL., Meded. Lands Plantent. 11 (1894) 236, [Bijdr. Boomsoort. Java 1: 236]; GAGNEP. in Lecomte, Fl. Gén. Indo-Chine 1 (1910) 563; KOORD., Atlas Baumart. Java 3 (1914) *pl. 434*.

Echinocarpus sigun BLUME, Bijdr. (1825) 56.

Echinocarpus murex BENTH., Linn. Soc. Bot. Jour. 5 (1861) Suppl. 71.

PALAWAN, Brooke's Point, Mount Mantalingahan, *Philip. Nat. Herb, 9, G. E. Edaño,* May 7, 1947, on forested slopes, alt. about 1,300 m. Assam and Burma to Indo-China, Hainan, Sumatra, Java, and Borneo.

With abundant material for comparison from Java, whence Blume's type came, as well as specimens from Assam, Hainan, Indo-China, Sumatra, and Borneo, we can see no reason for distinguishing this Philippine form. If we accept the reduction of *Echinocarpus murex* Benth., who when he described it had seen no specimens of *E. sigun* Blume, and with an isotype of this species before the senior author, Kurz and Gagnepain's reduction is accepted. This striking species has not, as yet, been reported from the Malay Peninsula.

OCHNACEÆ

Genus NECKIA Korthals

NECKIA PHILIPPINENSIS sp. nov. **Plate 2.**

Suffrutex erectus, circiter 45 cm altus, caulibus simplicibus, 5–7 mm diametro, vetustioribus glabris; foliis numerosis, confertis, chartaceis, oblanceolatis, glabris, supra pallide olivacies, subtus pallidioribus, 12–15 cm longis, 2.5–3 cm latis, deorsum longe angustatis, basi cuneatis, apice distincte acuminatis breviter apiculatis marginibus irregulariter acute serrulatis, serraturis plus minusve incrassatis, incurvato-mucronatis, nervis lateralibus numerosis, patulis, inter se circite 2 mm distantibus, petiolo 3–4 mm longo; stipulis pectinato-pinnatisectus, persistentibus (in partibus foliiferis), segmentis numerosis, filiformi-aciculatis, 1–1.5 cm longis, pallide brunneis, floribus axillaribus et in axillis defoliatis, solitariis et depauperato-fasciculatis, pedunculis cum pedicellis gracilibus 2.5–4 cm longis, bracteolis 3–5-paribus gerentibus hic linearis, acuminatis, 1.5–2 mm longis, inter se 5–7 mm distantibus; sepalis 5, ovatis vel oblongo-ovatis, circiter 7 mm longis, 3.5–4.5 mm latis, acuminatis, perspicue serratis, dentibus angustis, ad 1 mm longis; petalis quam sepalis dimidio brevioribus.

SAMAR, Bagacay, Concord, *Philip. Nat. Herb. 6248 M. D. Sulit,* April 21, 1948, near streams in shade, in dipterocarp forests, alt. about 200 m.

This is the first representative of the small genus *Neckia* to be found in the Philippines, and is distinguished, among other characters, by its relatively broad serrulate sepals. Airy-Shaw, Kew Bull. (1940) 251, has provided a key to seven species and two varieties mentioning the inadequately described Bornean *Neckia*

ovalifolia Capit. as probably being a synonym of some one of the other recognized species. The generic range is the Malay Peninsula, Sumatra, Borneo, and now Samar in the Philippines. The alliance of this new species seems to be with the Sumatran *N. grandiflora* Ridl., and with the Sumatra–Bornean *N. serrata* Korth. It differs from the former in its smaller leaves and flowers, and from the latter particularly in its broader sepals, and the several pairs of bracts or bracteoles.

FLACOURTIACEÆ

Genus HYDNOCARPUS Gaertner

HYDNOCARPUS PALAWANENSIS sp. nov. **Plate 3.**

Arbor parva, fructibus exceptis (floribus ignotis) glabra; foliis subcoriaceis, in sicco pallide olivaceis, utrinque concoloribus vel subtus paullo pallidioribus, opacis, plerumque oblongis vel late oblongo-lanceolatis, 6–15 cm longis, 2.5–5 cm latis, distincte acuminatis, acuminibus haud falcatis, basi persipicue inaequilateralibus, acutis, nervis primariis utrinque 5–7, distinctis subtus elevatis, curvato-adscendentibus, arcuato-anastomosantibus, distantibus, reticulis ultimis distinctis, utrinque elevatis; petiolo 5–9 mm longo; inflorescentiis axillaribus, solitariis, 1–3 cm longis, haud ramosis, tenuiter pedunculatis, leviter pubescentibus; floribus ignotis, alabastris valde immaturis paucis in partibus superioribus (2–3 mm) dispositis; fructibus globosis, maturis 4–5 cm diametro, pericarpio fragili vix 2 mm crasso, extus dense breviter pubescenti in fructibus immaturis dense verruculoso; seminibus saltem 10–15, circiter 2 cm longis extus rotundatis, intus plus minusve angulatis.

PALAWAN, Bacungan, near Puerto Princesa, *Philip. Nat. Herb. 192 G. E. Edaño,* March 27, 1947, along streams in forests at low altitudes.

The collector notes that the plant was 3 m high, its trunk diameter 15 cm, for which reason we have described it as a small tree, thinking that the indicated height to be an error. It is apparently allied to *Hydnocarpus subfalcata* Merr., but has much larger fruits than that species; although, like it, fruits with a distinctly thin pericarp. One of its striking characters is in its leaves having distinctly inequilateral bases, one side being much narrower than the other and very acute, the wider side being broadly acute to almost rounded. In this character, as well as in its glabrous fewer-nerved leaves it differs from *Hydnocarpus unonifolia* Elm., the type of which was from the same general

locality. Sleumer, Bot. Jahrb. 69 (1938) 57, has correctly reduced *Hydnocarpus quadrasii* Elm. to *H. subfalcata* Merr.

Genus FLACOURTIA L'Héritier

FLACOURTIA JANGOMAS (Lour.) RAEUSCHEL.

Flacourtia jangomas (Lour.) Raeuschel, Noemencl. ed. 3 (1797) 290; Steud., Nomencl. (1821) 343; Koord. and Val., Atlas Baumart. Java 2 (1914) *pl. 334;* Van Slooten, Bull. Jard. Bot. Buitenz. III, 7 (1925) 375; Merr., Am. Philos. Soc. Trans. II, 24 (1935) 274.
Stigmarota jangomas Lour., Fl. Cochinch. (1790) 634.
Flacourtia cataphracta Roxb. ex Willd., Sp. Pl. 4 (1805) 830.
Roumea jangomas Spreng., Syst. 2 (1825) 632.

Luzon, Laguna Province, Los Baños, *Philip. Nat. Herb. 6925 M. D. Sulit,* May 13, 1947, *Philip. Nat. Herb. 12218 D. R. Mendoza,* August 28, 1949, "planted (for its edible fruits) and naturalized." India to Burma, Indo-China, the Malay Peninsula, and planted in various islands of the Malay Archipelago, Sumatra, Borneo, Kangean, Java, its present distribution, in part, possibly even in the Malay Peninsula, is due to the species having been distributed by man. It is planted here and there in tropical America. As from its relatively recent original introduction at the College of Agriculture at Los Baños it has already become naturalized, publication of this record seems to be advisable.

Genus CASEARIA Jacquin

CASEARIA PAUCINERVIA sp. nov.

Frutex erectus, circiter 2 m altus, ramulis junioribus exceptis glaber, ramis teretibus, pallidis, glaberrimis, ramulis, teretibus vel obscure sulcatis, brunneis, plerumque glabris, minimis (junioribus) distincte fractiflexis et dense molliter cinereo-pubescentibus foliis valde immaturis gerentibus; foliis maturis plerumque ellipticis vel subellipticis, subcoriaceis, glabris, 5–8 cm longis, 2–4 cm latis, integerrimis, basi late acutis, apice breviter subobtuse acuminatis, utrinque nitidis, in sicco brunneis vel pallidis, concoloribus; nervis primariis utrinque 3, rariter 4, curvato-abscendentibus, ad marginem arcuatoanastomosantibus, utrinque perspicuis, subtus elevatis; petiolo 8–10 mm longo, glabro; capsulis axillaribus, solitariis, glabris, flavidis, in sicco brunneis, circiter 1.2 cm longis et 1 cm latis; pedicellis 2 mm longis, pubescentibus sepalis persistentibus, ovato-ellipticis, rotundatis, glabris; seminibus circiter 10, ad 5 mm longis, arillis plus minusve laciniatis.

Samar, Mount Calbiga, near Taft, *Philip. Nat. Herb. 6445 M. D. Sulit,* May 22, 1948, in dipterocarp forest, alt. 300 m near kilometer 64 of the Taft road.

Like other species of this genus the leaves are abundantly supplied with numerous, small, nearly round (rather than elongated) translucent cells. Its most striking character is its few-nerved leaves. The indumentum is confined to the very young branches which bear incipient leaves and are distinctly zig-zag in contrast to the mature, glabrous, strictly straight branchlets bearing mature leaves and fruits.

LYTHRACEÆ

Genus CUPHEA P. Browne

CUPHEA CARTHAGINENSIS (Jacq.) Macbr.

Cuphea carthaginensis (Jacq.) MACBR., Field Mus. Nat. Hist. Publ. Bot. 8 (1930) 124.
Lythrum carthaginensis JACQ., Stirp. Am. Hist. (1763) 148.
Cuphea balsamona CHAM. and SCHLECHT., Linnæa 2 (1827) 363; KOEHNE, Pflanzenr. 17 (iv. 216) (1903) 122; BACKER and VAN SLOOTEN, Geillust. Handb. Jav. Theeonkr. (1924) 181, *pl. 181.*

MINDANAO, Lanao Province, Mt. Saguiran, *Liborio Ebalo 1146*, February 26, 1941, with the local name *kataratara.*

Wildly distributed in tropical America, naturalized in Hawaii, Samoa, Fiji, Java, and doubtless other parts of the Old World tropics. A second species of the genus, *Cuphea micropetala* H. B. K., is cultivated at the College of Agriculture at Los Baños, Laguna Province, Luzon, *Philip. Nat. Herb. 8409 M. D. Sulit.* The genus is new to the Philippine list.

UMBELLIFERÆ

Genus APIUM Linnæus

APIUM LEPTOPHYLLUM (Pers.) F. Muell. ex. Benth.

Apium leptophyllum (Pers.) F. MUELL. ex BENTH., Fl. Austral. 3 (1866) 272; SPRAGUE, Jour. Bot. 61 (1923) 131, *cum. syn.*
Pimpinella leptophylla PERS., Syn. 1 (1805) 324.
Cyclospermum leptophyllum SPRAGUE, l.c.

LUZON, Mountain Province (Benguet), Baguio, *Philip. Nat. Herb. 6829 R. E. Galang*, January, 1948, alt. 1,400 m.

Sprague, Jour. Bot. 61 (1923) 129–133, critically considered the place of origin, history, and synonymy of this now pantropic weed, indicating rather clearly that it came from tropical America. He listed about fifteen synonyms. It was long confused with *Sison ammi* Linn.=*Apium ammi* auctt., but the Linnæan species is a synonym of *Carum copticum* (Linn.) Benth. and Hook. f. With the establishment of this tropical American weed in the Philippines the genus *Ammi* Linn., previously represented

only by the cultivated celery (*Ammi graveolens* Linn.), is definitely to be added to the generic list.

ERICACEÆ

Genus RHODODENDRON Linnæus

RHODODENDRON ACROPHILUM sp. nov. § Euvireya.

Frutex circiter 1 m altus, subglaber, ramulis junioribus et subtus foliis plus minusve lepidotis glabrescentibus; ramis ramulisque teretibus, ramis glabris, ramulis ultimis lepidotis, circiter 1 mm diametro; foliis verticillatis, brevessime petiolatis, coriaceis, oblongo-ellipticis, in sicco brunneis vel supra olivaceis, opacis 2.5–5 cm longis, 1–2 cm latis, utrinque acutis, junioribus subtus plus minusve lepidotis mox glabris, maturis subtus plane glandulosis (glandulis haud impressis); nervis primariis utrinque 6–8, subadscendentibus, haud perspicuis; petiolo 1–2.5 mm longo; floribus plerumque solitariis, campanulatis, circiter 3 cm longis, albido-flavidis pedicellis circiter 1 cm longis, consperse lepidotis; bracteis ignotis; calycis disciformibus; corollæ tubo circiter 1.5 cm longo, sursum plus minusve ampliato, deorsum extus parcissime lepidoto vel glabro, intus pubescenti, lobis ovatis, rotundatis, tubo aequantibus glabris; filamentis deorsum perspicue pubescentibus, sursum glabris; antheris oblongis, utrinque obtusis, 2.5–3 mm longis; ovario dense lepidoto, stylo 1 cm longo, glabro; capsulis cylindraceis, breviter acuminatis, circiter 3.5 longis, 5 mm diametro, logitudinaliter sulcatis, brunneis, consperse, lepidotis.

PALAWAN, Mount Mantalingahan, Brooke's Point, *Philip. Nat. Herb. 34* (type), *354 G. E. Edaño*, May 5 and 13, 1947, in the mossy forest at the summit, altitude about 1,600 m.

In aspect this species suggests *Rhododendron whiteheadii* Rendle of the mountains of northern Luzon, but it differs from that species in very many characters, its glabrous or at most slightly lepidote but not pubescent corollas, its yellowish-white flowers, its lepidote, not pubescent ovaries, etc. The very young branchlets are lepidote, but soon become glabrous, and while the young leaves are somewhat lepidote beneath they quickly become glabrous, the mature ones being distinctly glandular beneath.

RHODODENDRON EDANOII sp. nov. § Solenovireya.

Species *R. copelandii* Merr. affinis, differt floribus multo brevioribus, ca. 2 cm longis. Frutex circiter 1 m altus, haud lepidotus; ramis ramulisque teretibus, ramis glabris, ramulis junioribus plus minusve furfuraceis, circiter 2 mm diametro; foliis verticillatis, ellipticis vel oblongo-ellipticis, coriaceis, 3–5.5

cm longis, 1–2.5 cm latis, utrinque glabris vel junioribus supra plus minusve furfuraceis, utrinque rotundatis vel obtusis, marginibus revolutis, opacis, supra subolivaceis, subtus plerumque brunneis et perspicus plane glandulosis; nervis primariis utrinque 4–5, supra plus minusve impressis, subtus inconspicuis, reticulis obsoletis; petiolo 5–7 mm longo, glabro; floribus albidis ca. 7 in umbellis sessilibus dispositis; bracteis brunneis, interioribus elliptico-ovatis, breviter acuminatis, sursum extus plus minusve furfuraceis, cetero glabris, exterioribus minoribus; pedicellis 12–14 mm longis, breviter furfuraceis; calycis disciformibus, 1.5 mm diametro; corollae tubo cylindrico, recto vel leviter curvato, 2–2.5 cm longo, 3.5–4 mm diametro, extus plus minusve furfuraceo, vix lepidoto, intus glabro, lobis elliptico-ovatis, circiter 8 mm longis, 6 mm latis, rotundatis; filamentis glabris, antheris cylindricis, 3 mm longis; ovario cylindrico, 5 mm longo, 2 mm diametro, breviter dense furfuraceo; stylo 1 cm longo, deorsum pubescenti, suraum glabro.

PALAWAN, Mount Mantalingahan, Brooke's Point, *Philip. Nat. Herb. 153 G. E. Edaño,* May 13, 1947, in the mossy forest, altitude about 1,600 m.

A species resembling *Rhododendron copelandii* Merr. of Mindanao but with very much shorter flowers. It differs also in many other points in its floral and vegetative characters.

APOCYNACEÆ

Genus ALYXIA R. Brown

ALYXIA ANGUSTISSIMA sp. nov. Plate 4.

Frutex scandens, ramulis ultimis brevissime puberulis exceptis (floribus ignotis) glaber, ramis pallidis, teretibus, glabris, ultimis subangulatis, circiter 1 mm diametro; foliis 3–4-natim verticillatis, angustissime lanceolatis vel lineari lanceolatis, utrinque plus minusve angustatis, basi acutis, apice obtusis, 3–5 cm longis, 2–5 mm latis, coriaceis, breviter petiolatis, supra olivaceis vel subatro-olivaceis, subtus pallidioribus, costa supra impressa, subtus elevata, nervis lateralibus subtus obsoletis, supra valde obscuris, utrinque circiter 15; inflorescentiis terminalibus, axillaribusque, 1-floris, breviter (sub fructu 1 cm) pedunculatis, sepalis persistentibus lanceolatis, acuminatis, glabris, 1.5 mm longis; fructibus breviter pedicellatis, ellipsoideis, apiculatis, circiter 12 mm longis et 6 mm diametro, haud moniliformibus.

LUZON, Mountain Province (Ifugao), Mount Polis, *Philip. Nat. Herb. 8018 M. Celestino,* May 29, 1948, scandent over stunted trees, altitude indicated as 1,080 m, but this is certainly too low.

Essentially characterized by its very narrow leaves, which are mostly straight but sometimes subfalcate, its 1-flowered peduncles, and its ellipsoid, apiculate, non-moniliform fruits. Its alliance is apparently with *Alyxia stenophylla* Merr. from which it is distinguished by its 1-flowered peduncles.

ALYXIA ECOSTATA sp. nov.

Frutex scandens 4–5 m altus, ramulis junioribus inflorescentiisque parcissime breviter pubescentibus exceptis glaber, ramis teretibus, glabris, vetustioribus in sicco rubris, lævis, intermediis pallide viridis, ultimis 1–1.3 mm diametro, obscure sulcatis, internodiis 1.5–6 cm longis; foliis 3–4-natim verticillatis, oblongo-ellipticis vel anguste obovato-ellipticis, coriaceis, sicco viridis, subtus pallidioribus, lævis, subnitidis, 3–4 cm longis, 1–1.5 cm latis, obtusis, deorsum plus minusve angustatis, basi cuneatis, margine revolutis, costa supra valde impressa, subtus elevata, nervis lateralibus obsoletis; petiolo 4–6 mm longo; inflorescentiis axillaribus terminalibusque, pedunculatis, umbellatim 5–6-floris, pedunculo 1–1.5 cm longo, pedicellis ad 2 mm longis, bracteis lanceolatis, acuminatis, circiter 1.5 mm longis, alabastris acuminatis, extus parce breviter pubescentibus.

SAMAR, Mount Calbiga, near Wright, *Philip. Nat. Herb. 6421 M. D. Sulit*, May 26, 1948, in mid-mountain forests, alt. about 300 m.

The flowers are immature, but as this form can not otherwise be matched it is here described as new. Its alliance seems to be with *Alyxia obovatifolia* Merr., which, however, has rather sharply angled ultimate branchlets, larger leaves, and 2-flowered inflorescences.

ALYXIA ROSMARINIFOLIA sp. nov. **Plate 5.**

Frutex scandens, glaber, ramis ramulisque teretibus vel ramulis obscure sulcatis vel subangulatis, ramis pallidis, ramulis ultimis glabris; foliis plerumque oppositis vel terminalibus 3-natim, rarissime 4-natim veticillatis, linearis, marginibus parallelis, sursum vix angustatis, 3–5 cm longis; 2–3 rariter 4 mm latis, coriaceis, rigidis, basi late acutis vel rotundatis, apice rotundatis, costa supra impressa subtus elevata, nervis obsoletis petiolo 1–3 mm longo; inflorescentiis ut videtur stricte terminalibus et 1-floris, pedunculo 6–12 mm longo; floribus ignotis; fructibus ellipsoideis, 5 mm longis, breviter pedicellatis, longe appiculatis, haud moniliformibus.

PALAWAN, Bacungan, near Puerto Princesa, *Philip. Nat. Herb. 176 G. E. Edaño*, March 23, 1947, near streams in forest at sea level.

A striking narrow leaved species, characterized by the linear leaves not narrowing at either base or apex, being abruptly rounded at the tip and broadly acute or obtuse at the base. The inflorescences appear to be strictly terminal and 1-flowered (flowers unknown). The small, not moniliform, strongly apiculate fruits are much smaller than are those of *Alyxia linearifolia* A. C. Smith, Sargentia 1 (1942) 107, *fig. 8*, of Fiji, the vegetative characters of which are very similar to those of this Palawan species.

COMPOSITÆ

Genus STRUCHIUM P. Browne

STRUCHIUM SPARGANOPHORUM (Linn.) O. Kuntze.

Struchium sparganophorum (Linn.) O. KUNTZE, Rev. Gen. Pl. 1 (1891) 366; S. MOORE in Fawc. and Rendle, Fl. Jam. 7 (1936) 155, *fig. 48*, cum syn.

Ethulia sparganophora LINN., Sp. Pl. ed. 2 (1763) 1171.

Sparganophorus vaillantii CRANTZ, Instit. 1 (1766) 261.

LUZON, Rizal Province, Ogong, *Philip. Nat. Herb. 4281 G. E. Edaño*, November, 1945, in semi-open country, at low altitudes. A pantropic weed, native of tropical America, apparently introduced into the Philippines during the war years. Now widely distributed in the Old World tropics.

We have hesitated in accepting *Struchium* P. Browne (1756) as the proper name for this genus, although it is older than *Sparganophorus vaillant* ex Crantz (1766); the latter is the more generally accepted name. Our doubt is due to the fact that Patrick Browne's Civil and Natural History of Jamaica, published in 1756, after the binomial system was established, is strictly pre-Linnæan in nomenclature; and although he has a technical description of the genus, accompanied by a figure showing details of the flowers, he nowhere in the work used the binomial system. Urban did not accept Browne's name for he used *Sparganophorus*; in recent years there seems to be an increasing tendency among botanists to recognize the validity of the new genera published by Browne. While the International Code of Nomenclature forbids the acceptance of accidental binomials which may appear in early polynomial works, the code is silent on the subject of validity or non-validity of new genera published in such volumes after 1753.

Genus EUPATORIUM Linnæus

EUPATORIUM ADENOPHORUM Spreng.

Eupatorium adenophorum SPRENG., Syst. 3 (1826) 420; POPE, Wayside Pl. Hawaii (1929) 250, *pl. 147*.

Eupatorium glandulosum H.B.K., Nov. Gen. Sp. Pl. 4 (1820) 122, *pl. 346;* MOORE in Fawc. and Rendle, Fl. Jam. 7 (1936) 179; DEGENER, Fl. Hawaii Nat. Park (1930) 306, *pl. 90 non Michx.*, 1803.

LUZON, Mountain Province (Benguet), Mount Santo Tomas, *Philip. Nat. Herb. 2149 E. Quisumbing,* February 9, 1948; Mount Pauai, *Philip. Nat. Herb. 7466 M. D. Sulit,* January 23, 1948, alt. 2,000 to 2,400 m, "this is a terrible weed, found everywhere from Baguio to Banaue," Sulit. Identification by Dr. I. M. Johnston.

Originally described from Mexico, but naturalized in Jamaica, Madeira, and, in the Pacific region, in Hawaii; also in Java. Doubtless introduced into the Philippines from Hawaii, and like many other weedy plants of American origin, once established under favorable conditions in the orient, it develops "Napoleonic ambitions" as Dr. Backer originally expressed it for various American weeds in Java. *Eupatorium adenophorum* Spreng. was published as a new name for the invalid *Eupatorium glandulosum* H. B. K., yet the later name, perhaps on the basis of weight of authority, is still used by most modern botanists.

Genus TRIDAX Linnæus

TRIDAX PROCUMBENS Linn.

Tridax procumbens LINN., Sp. Pl. (1753) 900; HOOK. f., Fl. Brit. Ind. 3 (1881) 311.

LUZON, Manila, *Philip. Nat. Herb. 2613 D. R. Mendoza, 5020 E. Quisumbing,* February, 1947, and March, 1948, a weed in vacant lots: Laguna Province, Los Baños, *Philip. Nat. Herb. 8453 M. D. Sulit,* October, 1946, a weed along railroad tracks. A species originally described from Mexico, now a pantropic weed.

This species has long been thoroughly established in the Indo-Malaysian region, Indo-China, etc., "abundant in various parts of India" before 1881. It is rather strange that it did not appear in the Philippines at an earlier date; apparently introduced during the war years.

ILLUSTRATIONS

PLATE 1

Acacia quisumbing MERR., sp. nov.: *1*, Flowering branch, × 0.5; *2*, detail of leaflets, × 2; *3*, branchlet showing spines, × 2; *4*, young flower-head, × 4; *5*, unexpanded flower, × 8; *6*, expanded flower, × 8; *7*, bract, × 30; *8*, pistil, × 16; *9*, views of stamens, × 32.

PLATE 2

Neckia philippinensis MERR. and QUIS. sp. nov.: *a*, Habit, × 0.5; *b*, hairs at base of peduncle, × 2.5; *c*, details of hairs, × 7.5; *d*, stipule, × 2.5; *e*, bud, × 2.5; *f*, flower, × 2.5; *g*, petal, × 5; *h*, section of fruit, showing seeds, × 5; *i*, stamen, × 10; *j*, seed, × 20.

PLATE 3

Hydnocarpus palawanensis MERR. and QUIS. sp. nov.: *a*, Fruiting branch, × 0.5; *b*, detail of leaf, × 0.5; *c*, seeds, × 2.

PLATE 4

Alyxia angustissima MERR. and QUIS. sp. nov.: *a*, leaves, × 1; *b*, fruits, × 1.5.

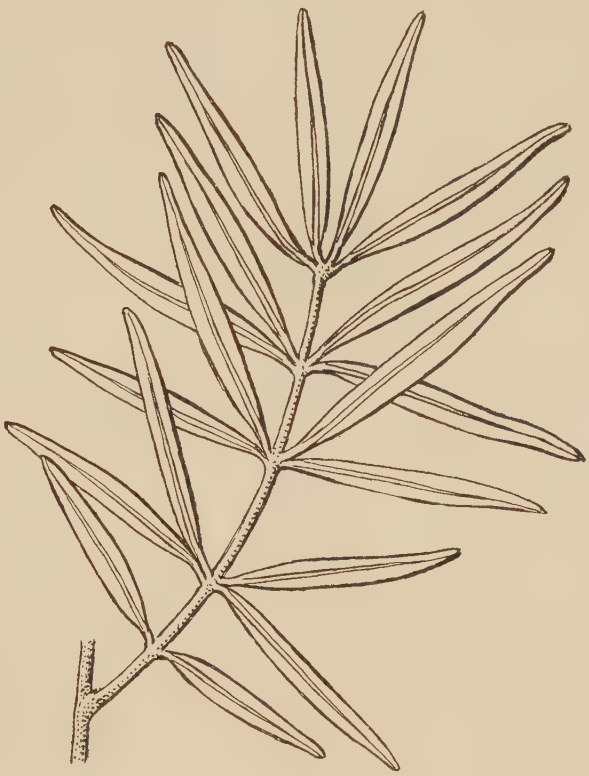
PLATE 5

Alyxia rosmarinifolia MERR. and QUIS. sp. nov.: *a*, Habit, × 0.5; *b*, fruit, × 1.5.

PLATE 1.

PLATE 2.

PLATE 3.



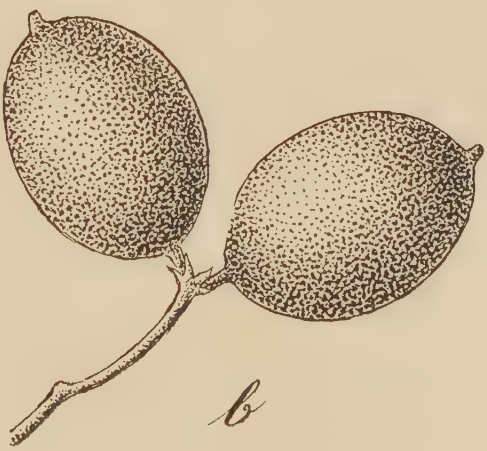


PLATE 4.

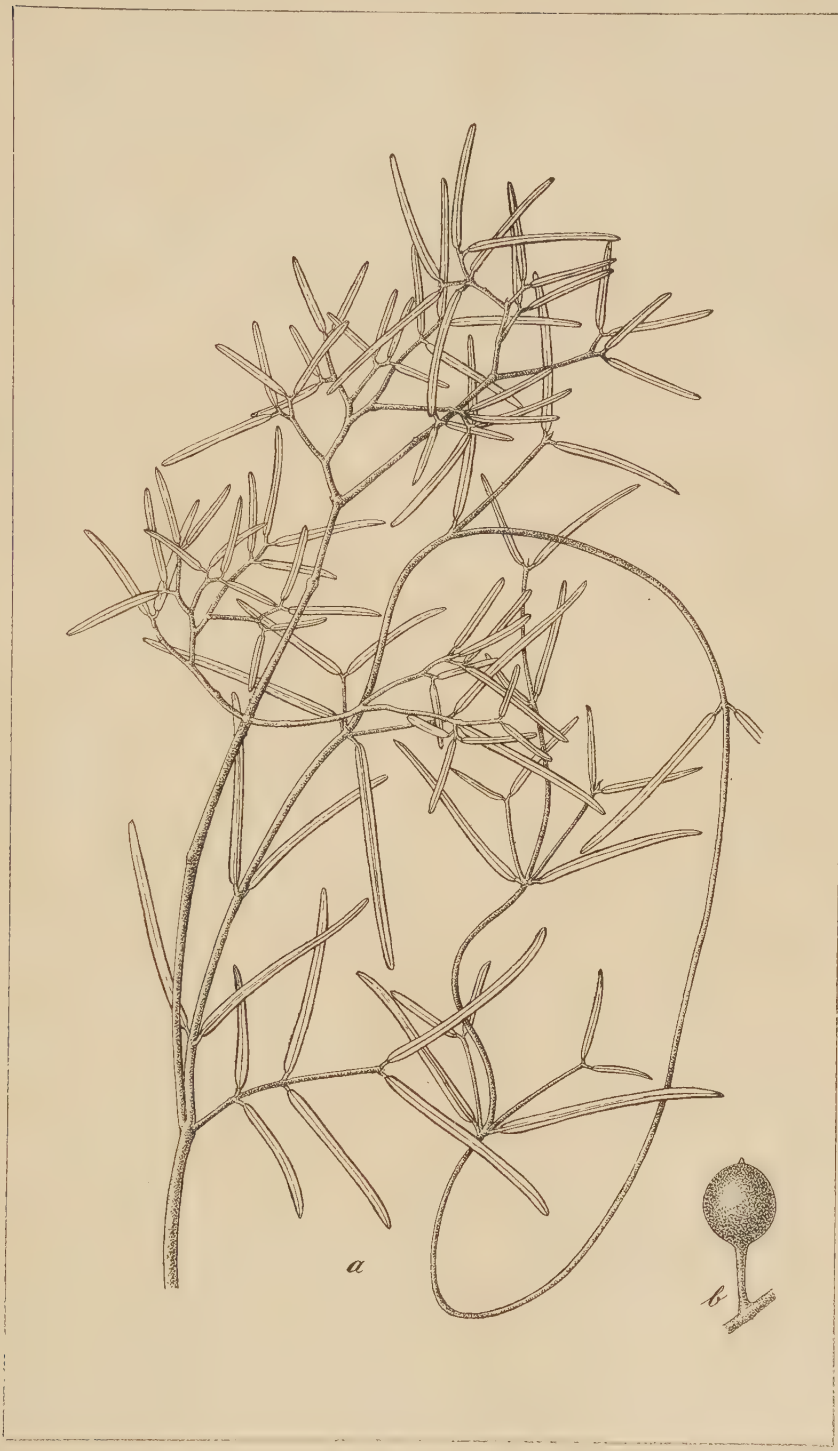


PLATE 5.

COMPOSITION OF PARA-RUBBER-SEED OIL

By Angelita M. Tuason and Aurelio O. Cruz
Of the Institute of Science and Technology, Manila

This oil is obtained from the seeds of para-rubber tree known botanically as *Hevea braziliensis* (HBK.) Müell.-Arg., of the Euphorbiaceæ. Recently we analyzed the para-rubber-seed oil from plants grown in the Philippines. Our results showed that the oil consists principally of glycerides of linolenic, linolic, oleic, and saturated acids and is similar in composition to lumbang oil.

The composition of para-rubber-seed oil has been the subject of a number of investigations (1, 2, 3,). The results showed that the percentage composition of the oil varies within a wide range. The linolenic glyceride content was from 2.5 per cent to as high as 20.5 per cent.

According to Yates (4), the original home of *Hevea braziliensis* is in tropical South America along the Amazon River and its tributaries, a region having a moist, warm climate, and a fairly uniform distribution of rainfall. A comparison of rainfall, temperature, and soil conditions obtaining in the southern part of the Philippine Archipelago with those in countries where para rubber is successfully cultivated indicates the suitability of the former region for *Hevea braziliensis*.

Para-rubber seeds are by-products of the rubber industry. Both the oil and cake have potential commercial values.

Rubber-seed oil, which belongs to the same class as Philippine lumbang oil, possesses drying properties. It can be used in the paint and varnish industry, in the manufacture of boiled oils and of paper and oiled tissues. It is similar to linseed oil when used in the manufacture of black and white substitute(5).

In Japan, the oil is used as insecticides and for waterproofing clothes, parasols, and paper. When incorporated with lac it yields a brilliant and translucent yellow varnish(6).

The cake remaining after expression of the oil forms a valuable animal feed on account of its high protein content.

Georgi, et al.(7) stated that rubber seed consists of approximately 40 per cent of shell and 60 per cent of kernels. Calculated on a moisture-free basis, the oil content of the kernels is slightly in excess of 50 per cent which corresponds to approx-

imately 25 per cent of the seed. They found that the kernel contains a powerfully acting lipolytic enzyme and a cyanogenetic glucoside which decomposes either as a result of enzyme action, or in a very acid medium, yielding hydrocyanic acid which diminishes gradually on storage. The amount of hydrocyanic acid in the meal from kernels which have been stored for 18 weeks has been found to be 0.01 to 0.02 per cent. In fresh kernels it appears to vary within a fairly wide limit, as much as 0.223 per cent, calculated on a moisture-free basis.

EXPERIMENTAL PROCEDURE

Para-rubber seed from Philippine plants weighs from 2.6 to 4.0 grams. The seed consists of 41.8 per cent of shell and 58.2 per cent of kernels.

The oil content of the kernels, calculated on a moisture-free basis, is 47.9 per cent.

The composition of the meal from the kernel as determined by our analysis is given in Table 1.

TABLE 1.—*Composition of rubber-kernel meal.*

	Per cent
Moisture	7.0
Oil (ether extract)	8.0
Protein	30.5
Crude fiber	6.1
Ash	4.9
Carbohydrates (by difference)	43.5
Total	100.00

As in former investigations(7, 10) the data (Table 1) show that the kernel meal has a high percentage of crude protein.

The oil used in this investigation was prepared (cold pressed) from para-rubber seeds which were kindly presented to us by Mr. Calixto Mabesa of the Bureau of Forestry, Los Baños. The oil was treated successively (warming, shaking, and filtering) with 2 per cent Fuller's earth and 0.5 per cent activated carbon. This treatment removed vegetable fibers and colloidal matter and produced a brilliantly clear yellow oil.

The constants of para-rubber-seed oil are given in Table 2.

TABLE 2.—*Physical and chemical constants of para-rubber-seed oil grown in the Philippines.*

Specific gravity at 30.6°C	0.9123
Refractive index at 29.5°C	1.4730
Saponification value	181.2
Acid value	5.1

Iodine number (Hanus)	133.3
Thiocyanogen value	85.6
Saturated acids (per cent)	14.6
Unsaponifiable matter (per cent)	1.1

The saturated acids that occur as glycerides in the para-rubber-seed oil were determined by the lead saltether method(8). The unsaturated glycerides were calculated from the iodine and thiocyanogen values of the oil in accordance with the Official and Tentative Methods of the American Oil Chemists' Society(9). The results are recorded in Table 3. Included in Table 3 are the composition of the oil expressed from kernels imported from Sumatra and analyzed by Jamieson and Baughman [a] and Philippine lumbang oil.[b] As shown by the data para-rubber-seed oil from plants grown locally is very similar in composition to the oil analyzed by Jamieson and Baughman. It has almost twice the linolenic glyceride content but a higher percentage of saturated glycerides when compared with Philippine lumbang oil. All these oils consist principally of glycerides of linolenic, linolic, oleic, and saturated acids.

TABLE 3.—*Comparison of para-rubber-seed oil from plants grown in the Philippines and Sumatra with other oils.*

	Rubber-seed oil		Philippine lumbang oil[b]
	Philippine	Sumatra [a]	
Glycerides of:	*Per cent*	*Per cent*	*Per cent*
Unsaturated acids:			
Oleic	29.2	28.5	40.4
Linolic	40.8	32.9	48.2
Linolenic	14.3	20.5	7.7
Saturated acids	14.6	17.1	2.1
Unsaponifiable matter	1.1	----------	0.3
Total	100.0	99.0	98.7

[a] Para-rubber-seed oil analyzed by G. S. Jamieson and W. P. Baughman. Oil and Fat Ind. 7 (1930) 419.
[b] Philippine lumbang oil analized by A. O. Cruz and A. P. West. Philip. Jour. Sci. 42 (1930) 256.

SUMMARY

Para-rubber seeds are by-products of the rubber industry. Both the oil and cake have potential commercial values.

In this investigation the composition of para-rubber-seed oil expressed from the seeds of Philippine plants was determined. Para-rubber-seed oil from local plants consists principally of the glycerides of linolenic, linolic, oleic, and saturated acids, and is very similar in composition to the rubber-seed oil from plants grown in Sumatra analyzed by Jamieson and Baughman. The

former has almost twice the linolenic glyceride content but a higher precentage of saturated glycerides when compared with Philippine lumbang oil. It belongs to the same class as linseed oil and possesses drying properties.

REFERENCES

1. PICKLES, S. S., and W. P. HAYWORTH. Composition of para-rubber-seed oil. Analyst 36 (1911) 491.

2. JAMIESON, G. S., and W. F. BAUGHMAN. Para-rubber-seed oil. Oil and Fat Ind. 7 (1930) 419.

3. GARDNER, H. A. Rubber-seed oil, and a method of producing glycerides fatty acids. Paint Manufrs. Assoc. U. S., Cir. 118 (1921) 1–2.

4. YATES, HARRY S. The growth of *Hevea brasiliensis* in the Philippine Islands. Philip. Jour. Sci. 14 (1919) 501–523.

5. AGRONOMIE COLONIALE, Bull. Mensuel Jardin Colonial (28) 4 (1919–1920) 122.

6. TREVITHICK, H. P., and M. F. LAURO. Rubber-seed oil. Cotton Oil Press (9) 5 (1922) 33.

7. GEORGI, C. D., V. R. GREENSTREET, and GUNN LAY TEIK. Storage of rubber seeds. Malayan Agri. Jour. 20 (1932) 164, 174.

8. JAMIESON, G. S. Vegetable fats and oils, their chemistry, production, and utilization for edible, medicinal and technical purposes. 2nd ed. New York, 1943. 508 p.

9. American Oil Chemists' Society. Official and tentative methods of the American Oil Chemists' Society, 2nd ed. Chicago Ill. The Society, 1946.

10. PADILLA, S. P., and FLORENCIO A. SOLIVEN. Chemical analysis for possible sources of oils of forty-five species of oil bearing seeds. Philip. Agri. 22 (1933) 408–415.

THE ELEOTRID GOBIES OF THE PHILIPPINES AND ADJACENT REGIONS

By Albert W. C. T. Herre
Of the School of Fisheries, University of Washington

The gobies are small and usually inconspicuous fishes of no direct importance in most parts of the world. In the Philippines and East Indies they are of much economic importance in certain regions, particularly in northern Luzon.

The gobies are the largest group of fishes in oriental tropical waters, with more than 235 species known from the Philippines alone. This large number, which will be increased with further exploration of Philippine waters, is distributed among six families and the bulk belong to the Gobiidæ or true gobies and the eleotrids or family Eleotridæ.

All gobies invariably have ventral fins on the thorax, each with a spine and five, or very rarely four or three, soft rays. The ventrals are very close together, the inner rays longer than the outer ones. In most of the gobylike fishes the ventrals are completely united to form a single fin, as in the well known *biang puti*. In the Eleotridæ the ventrals are more or less disconnected, and are never united with a frenum or membrane across the base to convert them into a vacuum cup or sucking disk with strong adhesive powers. They are, however, near enough together so that they are used for clinging to rocks, sticks, or other objects in the water or on the bottom of a stream or pool.

The spinous dorsal is short, nearly always of six feeble spines, very rarely fewer or more. The soft dorsal is always longer, a spine and with from 8 to 32 rays. The anal is opposite the soft dorsal and very similar, with a spine and 7 to 32 rays. The dorsals are separate or may be united only at the base. Ventrals with a spine and usually five rays; rarely there are but four or three.

As in all gobies there is no lateral line. The scales may be ctenoid or cycloid, wholly so or part of the body with one kind and part with the other. In some kinds the body is wholly naked, or largely so. The number of scales varies from 22 to 170. The body is more or less elongate, cylindrical or laterally compressed. There are from four to six branchiostegals. In

some genera one or more of these may end in a prominent sharp forward-projecting point. An air bladder is present in most eleotrids.

Eleotrids are abundant in Philippine, East Indian, and southeastern Asiatic waters, especially in shallow bays, inlets, river mouths, and the lower reaches of fresh-water streams. Some of them are exclusively marine, but the largest and economically most important ascend rivers and enter lakes, and go far beyond influence of the tides. Some kinds go upstream into the mountains, as long as they are not stopped by waterfalls or dams. When mature, they go back downstream to brackish water or to the sea and spawn. The fry of these migratory species enter the mouths of rivers in dense schools. They are caught then in great quantities, and are eaten fresh but most of them by far are made into *bagoong* or *guinamos*, called *belachan* in Malay.

Most eleotrids are plainly colored, usually brown or dusky and inconspicuous, but a few species, especially some of the coral reef inhabitants, are brilliantly or handsomely colored.

One of the eleotrids, *Ophiocara aporos*, called *bañgañgay* and *palowon* in Tagalog, is the handsomest fresh-water fish of the Philippines. It is the only gorgeously colored fish living in the muddy dark waters of Philippine lowland streams. In life the general effect is dark green and gold. No two fish are exactly alike. There are usually two irregular rows of large golden spots connected by cross bars along the sides. Two dark green stripes are present from the eye to the edge of the preopercle, and another crosses the opercle and cuts in two a large golden spot on the pectoral base. Often there are also red or orange spots on the sides, and the dark green of the body may be pale green or even electric blue. Sometimes the head stripes are lavender and there may be violet or lavender marks on the sides and caudal fin. The soft dorsal has large golden spots, often on a blue or green membrane.

Many of the eleotrids are able to change their color to a remarkable degree, according to the character of the background and the amount of light. By changing their color and its pattern they can hide successfully without moving from their positions.

In addition to the use of the fry, the adults of the larger eleotrids are caught for food. The larger species are robust thick-bodied fishes and are good eating. They are commonly seen in Philippine, Bornean, and Malayan markets, and are often kept alive to ensure their being perfectly fresh.

This paper does not contain descriptions, but is offered as a means for the ready identification of the eleotrid gobies now known from the Philippines and East Indian area. The keys used are simple and practical. Lengths given are the standard length, measured from the tip of the snout to the last vertebra of the backbone; the tail is not included.

Key to the genera of Eleotridæ in the Philippines and tropical Western Pacific

I. Head armed.

A. Angle of preopercle armed.

B. With a single stout curved spine or else with 3 to 6 teeth or short spines at the preopercular angle ..... 1. *Asterropteryx.*

BB. With a downward curved sharp spine, sometimes hidden and hard to find ..... 2. *Eleotris.*

AA. Angle of preopercle not armed; one or two branchiostegals end anteriorly in a sharp spine pointing forward and upward; head naked; upper pectoral rays loose flossy, silklike 3. *Belobranchus.*

II. Head not armed.

C. Resembling cyprinid fishes, the head and body laterally compressed. 4. *Hypseleotris.*

CC. Species typically gobiiform.

D. Teeth on vomer.

E. A patch of small teeth on the head of the vomer: body covered with very small cycloid scales 130 to 150..... 5. *Bostrichthys.*

EE. Two large teeth set transversely on vomer.

F. Teeth fused to form a unit; scales cycloid, 150 to 160; dorsal and anal rays 24 to 30 ..... 6. *Gracileotris.*

FF. Vomerine teeth distinctly two but fused to form a low ridge; scales ctenoid, 60 to 75; dorsal and anal rays 10 to 16. 7. *Zebreleotris.*

DD. No teeth on vomer.

G. Head large, blunt, about twice in trunk; snout and cheeks with many rows of skinny papillate ridges; no canines; mouth strongly oblique, posterior scales ctenoid, the rest cycloid. 8. *Gobiomorphus.*

GG. Head without conspicuous rows of cutaneous papillate ridges.

H. Head with bony crests, either serrated or smooth.

I. Scales on sides ctenoid and less than 50.

J. Scales 26 to 30; first dorsal with 6 spines.

K. Head very long, pointed, prismatic, its height equal to its breath; lower jaw very prominent.... 9. *Butis.*

KK. Head very short, obtuse, wider than deep, the lower jaw scarcely projecting; crests strongly elevated and serrate ..... 10. *Prionobutis.*

JJ. Scales on sides 36 to 46; first dorsal VI to VIII, usually VII ..... 11. *Odontobutis.*

II. Scales on sides cycloid, 80 to 100; 2 curved canines in upper jaw and 4 in lower jaw..... 12. *Odonteleotris.*

HH. No bony crests on head.

L. Head large, broad, depressed; lower jaw prominent.

M. First dorsal with 4 or 5 spines.

N. First dorsal IV or V; second dorsal I–7; scales ctenoid, 55 in lateral series; 36 predorsal cycloid scales; 8 or 10 rows of minute teeth in each jaw ..... 13. *Lizettea.*

NN. First dorsal V; second dorsal I–10; all scales cycloid, 85 to 100 in lateral series; 55 to 65 predorsal; outer teeth enlarged with several rows of small teeth behind ..... 14. *Paloa.*

MM. First dorsal with 6 spines.

O. Snout and cheeks with many short filaments; scales ctenoid with many accessory scales; head broad, depressed; teeth villiform; outer row above enlarged; lower jaw with an outer and an inner row of larger teeth. 15. *Pogoneleotris.*

OO. Snout and cheeks without filaments; scales in lateral series 30 to 70; predorsal scales 13 to 65.

P. Four rows of teeth in each jaw, the outer and inner rows enlarged; scales all cycloid, or those on sides ctenoid, 50 to 70 in a lateral series; predorsal scales 30 to 42.... 16. *Boroda.*

PP. Six to ten rows of small to minute teeth in each jaw; no canines.

Q. Head blunt, snout broad.

R. A broad naked furrow above eye, separated from it by a single row of small scales; 52 to 60 ctenoid scales in a lateral series; other scales all cycloid, predorsal 42 to 46; second dorsal and anal much higher than first dorsal ..... 17. *Bunaka.*

RR. Furrow above eye, when present, not separated by a single row of scales.

S. Scales in lateral series 28 to 40; predorsal 13 to 26, those on top of head conspicuously enlarged ..... 18. *Ophiocara.*

SS. Scales all cycloid, 85 to 90 in lateral series; predorsal scales very small and crowded; vertical fins all low, the first dorsal lowest; eye superior, noticeably small, 11.5 to 12 times in length of head ..... 19. *Gigantogobius.*

QQ. Head pointed, snout narrow; scaled above and on sides; scales all ctenoid, 45 to 100 in lateral series; predorsal scales 26 to 65; no canines; soft dorsal rays 9 to 12; anal rays 7 to 10..... 20. *Oxyeleotris.*

LL. Head not noticeably large, broad, and depressed.

T. Dwarf fishes, adults not exceeding 30 mm, as far as known.

U. Ventrals I–3.

V. Body naked; second dorsal I–13 to 18; anal I–12 to 18 ..... 21. *Herreolus.*

VV. Scales cycloid, 75 to 100 in lateral series; second dorsal and anal I–15 to 18. 22. *Andameleotris.*

UU. Ventrals 1–4, long, narrow, with fringed rays; scales ctenoid, 22 to 28 in longitudinal series ..... 23. *Eviota.*

UUU. Ventrals I–5; scales cycloid anteriorly, ctenoid behind tip of pectoral, 48 to 50 in lateral series..... 24. *Luzoneleotris.*

TT. Adult fishes more than 30 mm long; scales 60 to 170 in lateral series; ventrals of ordinary shape.

W. Ventrals I–5.

X. Scales all ctenoid.

Y. Eye usually much less than snout, rarely equal to it; lateral scales 70 to 130; head naked; predorsal scales few or none; lower jaw with a pair or several pairs of canines ..... 25. *Valenciennea.*

YY. Eye more than snout; lateral scales about 64; predorsal scales 15 to 20, head otherwise naked 2 pairs of canines above, 1 pair in lower jaw; ventral and caudal both longer than head. 26. *Pteroculiops.*

XX. Anterior scales cycloid, posterior scales ctenoid, 80 to 85 in lateral series; no predorsal scales; 3 pairs of canines in lower jaw; dorsal and anal rays 12 to 13 ..... 27. *Amblyeleotris.*

XXX. Scales 100 to 110, cycloid (?); ventral equals head; snout 5 in head, much shorter than eye, which is 3 in head; first dorsal spine threadlike, reaching base of last second dorsal ray; no canines; dorsal rays 28; anal rays 24 ..... 28. *Nemateleotris.*

WW. Ventrals I–4; mouth oblique to nearly vertical, with prominent chin.

Z. Scales cycloid.
a. No barbels on chin.
b. Caudal broadly rounded; scales 160 to 170; second dorsal and anal rays 10; eye 2 in snout; upper jaw with a pair of median canines behind other teeth ..... 29. *Parviparma.*
bb. Caudal lunate; scales 100 to 170; second dorsal and anal rays 24 to 32; eye equal to or more than snout; lower jaw with a pair or several pairs of canines.... 30. *Pterelectris.*
aa. One or more barbels on chin.
c. Chin with single median barbel; dorsal rays 28; anal rays 26; caudal truncate, equals head; eye more than snout; scales minute, partly embedded; no canines. 31. *Pogonoculius.*
cc. Chin with flat median barbel head, upper and lower rays hind it; caudal longer than head, upper and lower rays forming long filaments; lower jaw with 2 large canines 2. *Vireosa.*
ZZ. Scales ctenoid, body compressed, mouth nearly vertical; 4 canines in each jaw.
d. Scales small, extending forward to eyes; caudal bluntly convex; second dorsal and anal rays 25 to 30 ..... 33. *Orthostomus.*
dd. Scales deciduous; about 100 to 110 in lateral series; caudal elongate, pointed, the central rays threadlike; soft dorsal and anal rays 30 to 32; head compressed above into a fleshy scale crest..... 34. *Oxymetopon.*

1. Genus ASTERROPTERYX Ruppell

The laterally compressed short and deep body is covered with large ctenoid scales, which are also on the sides of the head.

It is separated from other eleotrids by having the angle of the preopercle armed. The armature may be a single long spine or may be stout teeth or spines, 3 to 6 in number. Scales 24 to 28; dorsals close together, VI–I–9 to 11; anal I–8 to 11. Small fishes not exceeding 40 mm in length. Species few.

Key to the Indo-Pacific species

A. Three to 6 stout teeth or short spines at the preopercular angle.
  B. Scales in lateral series 27 or 28; body pale olive brown; a small black shoulder spot ..... *A. everetti.*
  BB. Scales in lateral series 24; body with blackish brown cross bands or blotches; in life each scale with a brilliant blue spot. *A. semipunctatus.*
AA. A single long sabrelike spine at the angle of the preopercle. *A. ensifer.*

DISTRIBUTION OF THE SPECIES OF ASTERROPTERYX

ASTERROPTERYX EVERETTI Boulenger.

This Philippine species is only known from the original collections in Balabac and in Palawan.

ASTERROPTERYX SEMIPUNCTATUS Ruppell.

This lovely little gemlike fish occurs throughout the tropical Indo-Pacific. It was first described from the Red Sea but extends eastward through the East Indies and Philippines to the Pelew, Samoan, Society, and Tuamotu islands. On some coral reefs they are excessively abundant, hundreds occurring on a few square meters. In the Philippines they are found on every coral reef, and are particularly common from Cebu southward. The largest are probably less than 50 mm in length.

ASTERROPTERYX ENSIFER Bleeker.

This singular and apparently very rare little eleotrid, with its great swordlike spine, was first known from Buru, an East Indian Island. Then three more were obtained in the Postillon Islands, also in the East Indies. Four were taken near Jolo, and a couple more at Bongao, Sulu Province. This eleotrid lives in and under great coral heads, so that it is very seldom seen.

Asterropteryx monacanthus Regan, from the Seychelles Islands, Indian Ocean, is apparently the same fish.

2. Genus ELEOTRIS Block and Schneider

The species of this genus have a thick and robust body and some of them reach a length of a fourth of a meter. However most specimens are small and the largest Philippine specimens thus far known do not exceed a length of 150 mm.

All members of this genus are easily recognized by the presence of a hard, sharp, downward-curved spine at the lower angle of the preopercle. Sometimes it is difficult to make out, but usually it is readily observed and living fish are able to make wounds with their spine.

The members of this genus are of economic importance, especially in northern Luzon. At certain times the fry are abundant in shallow bays and inlets, and great shoals of tiny fish enter estuaries and river mouths and begin their ascent of streams. They are then taken in great quantity and used for making *bagoong*, although many are eaten fresh.

In addtion to the species of *Eleotris* listed here, other species have been reported from New Guinea, but their true generic affiliations are not clear. In the absence of material for study to settle the matter it is best to omit them.

Key to the Philippine and East Indian species of Eleotris.

A. Scales in lateral series 58 to 65; predorsal scales 48 to 50; scales from second dorsal origin to anal origin 16 to 19..... *E. fusca.*
AA. Scales in lateral series 42 to 55.
B. 14 or 15 scales in transverse series from the second dorsal origin to the anal origin; 47 to 55 scales in lateral series.
C. 10 to 12 scales across the middle of the caudal peduncle; scales of caudal peduncle not larger than those on middle of side; no scales on snout.
D. A wide dusky strip from head to caudal along middle of side; small black dots scattered on stripe and below it..... *E. balia.*
DD. No stripe or dots as above.
E. Head 3 to 3.2 in the length; teeth nearly uniform, or those of the outer row above a little larger..... *E. melanosoma.*
EE. Head less than 3 in the length; the outer and inner rows of teeth in both jaws larger than the others. *E. macrocephalus.*
CC. 8 scales across the middle of the caudal peduncle; scales of peduncle much larger than those on middle of trunk; teeth and length of head as in *E. macrocephalus*..... *E. oxycephalus.*
BB. 11 or 12 scales from second dorsal origin to anal origin; 8 or 9 scales across middle of caudal peduncle; head 3 or more than 3 times in the length; scales on caudal peduncle not or scarcely larger than those on middle of trunk.
F. About 50 scales in a longitudinal series; depth about 6 to 7 in length, including the tail..... *E. insulindicus.*
FF. 42 to 45 scales in lateral series; depth 5 times in length, including the tail ..... *E. macrolepis.*

ELEOTRIS FUSCA (Block and Schneider).

This dark colored and retiring fish, known as *mulug*, occurs in streams near the sea and in swamps from Pangasinan

Province southward throughout the Philippines. It hides among stones or lies on the bottom where its color blends with its background so that it can hardly be seen. It also hides under grasses and masses of roots along the banks of streams and in ponds and thus escapes observation.

The *mulug* begins to spawn when only 36 mm long, but may reach a length of 275 mm, though such large examples are not yet recorded from the Philippines.

The *mulug* occurs from the streams along the East coast of Africa and from Madagascar to India, the East Indies, the Hawaiian and Society islands. It extends northward along the China coast to the Riu Kiu Islands.

ELEOTRIS BALIA Jordan and Seale.

This species is only known from the coasts of central and southern China and the island of Hainan. It may well occur on the Ilokano coast and among the Batanes Islands. It attains a length of about 175 mm.

ELEOTRIS MELANOSOMA Bleeker.

This is the well-known *virot* of the Ilokano provinces. The fry are one of the principal sources of *bagoong* in the north of Luzon. The *virot* does not have the wide range of the *lamug*. It is abundant in the northern half of Luzon, but is not so plentiful in the southern part of the Islands. Elsewhere it occurs from Sumatra to New Guinea and New Caledonia. In appearance and habits it agrees with the *mulug*.

This little eleotrid probably never exceeds a length of 125 mm.

ELEOTRIS MACROCEPHALUS Bleeker.

This rare species is only known from Amboina and Buru.

ELEOTRIS OXYCEPHALUS Bleeker.

This species occurs on the coasts of Japan, China, the East Indies, and Australia, and should be in the Philippines. It reaches a length of 230 mm or more. No doubt it is confused with the *virot*.

ELEOTRIS INSULINDICUS Bleeker.

This eleotrid is widely distributed in the East Indies, where it is found in river mouths. It is another small fish, perhaps never more than 120 mm long.

ELEOTRIS MACROLEPIS Bleeker.

This species is known only from Amboina. The two specimens were 70 and 81 mm in length.

3. Genus BELOBRANCHUS Bleeker

This unique genus is recognized by the following characters:—the head is naked; the upper pectoral rays are free and silklike; and the first branchiostegal ends in a sharp spine pointing forward and upward. Sometimes the first and second branchiostegals both end in a forward-pointing spine. No other eleotrid has such a combination of characters.

But one species is known, confined to the rivers and estuaries of the East Indian region. Growth stages and color phases have been described as separate species, but of course were not valid.

BELOBRANCHUS BELOBRANCHA (Cuv. and Val.).

This attractive fish, with handsomely spotted fins and plump, robust, form, has been reported from the hill streams of Luzon, Alabat, Mindoro, Negros, and Mindanao. With this known distribution it is evident that it lives in the rivers of all the larger islands in the Philippines. It reaches a length of 180 mm or more, and is much esteemed for food by the people living along hill streams.

It is known from the East Indian islands of Bali, Batjan, Borneo, Celebes, and Ceram. Again, this distribution shows that it must occur generally in the hill streams throughout the East Indies.

4. Genus HYPSELEOTRIS Gill

In the Philippines and East Indies.

These are free swimming fresh-water fishes in the Philippines and East Indies, but one from the Society Islands is marine. The following key gives those thought to be in the East Indian region.

A. Head with stripes.
  B. Two brown stripes from eye across cheek to operculum; 25 scales in lateral series ..... *H. agilis.*
  BB. A brown stripe from eye to throat; 28 scales in lateral series. *H. tænionotopterus.*
AA. No crossbands or diagonal stripes on head.
  C. A black longitudinal band on lower half of body..... *H. güntheri.*
  CC. No black longitudinal band along side.
    D. 25 scales in a longitudinal series; pectoral with a double black and yellow basal spot ..... *H. leuciscus.*
    DD. 26 to 29 scales (usually 28) in a longitudinal series; a dark crossbar on pectoral base.
      E. A blackish line along middle of side; anal papilla large, very broad and long, with notched tip.

F. 15 predorsal scales; caudal truncate with rounded corners, much shorter than head ..... *H. pangel.*

FF. 17 to 19 predorsal scales; caudal equal to head, with elongate pointed tip ..... *H. quisumbingi.*

EE. No black line along middle of side.

G. Color in alcohol uniform; brown spot on lower half of caudal base; genital papilla small, slender; second dorsal and caudal faintly barred with brown or black. *H. modestus.*

GG. Color in alcohol blackish or brownish grey, a conspicuous black spot or vertical bar on caudal base; genital papilla long, with lunate tip; caudal clear or golden; males with second dorsal deep black with circular white spots ..... *H. bipartita.*

DISTRIBUTION OF HYPSELEOTRIS IN THE PHILIPPINES AND EAST INDIES

HYPSELEOTRIS AGILIS Herre.

Occurs in Mindanao, Mindoro, and Luzon.

HYPSELEOTRIS BIPARTITA Herre.

As yet this little fish has only been found in Albay Province, Luzon.

HYPSELEOTRIS GÜNTHERI (Bleeker).

Reported from Negros Oriental under the name of *H. cyprinoides.* True *H. cyprinoides* is only known positively from the island of Reunion, in the Indian Ocean. *H. güntheri* ranges over the tropical Pacific, from Kusaie in the Carolines to Samoa, Fiji, and New Caledonia.

HYPSELEOTRIS LEUCISCUS Bleeker.

This species is only known as yet from Sumatra.

HYPSELEOTRIS MODESTUS (Bleeker).

This species has been found in Mindoro, Leyte, and Palawan, and no doubt occurs throughout the central Philippines.

Bleeker's specimens were from Singapore and Sumatra.

HYPSELEOTRIS PANGEL Herre.

This species occurs in Cavite Province, Luzon, and probably all over central and southern Luzon.

HYPSELEOTRIS QUISUMBINGI Roxas and Ablan.

Only known from market specimens at San Fernando, La Union Province, Luzon.

HYPSELEOTRIS TÆNIONOTOPTERUS (Bleeker).

Recorded only from Bali.

5. Genus BOSTRICHTHYS Dumeril

Characterized by a patch of teeth on the vomer. Only 2 species of this genus are known, one of wide distribution, the other only known from New Guinea.

Key to the species of Bostrichthys

A. A large white-margined ocellus or eye spot on the caudal base; dorsal VI–I–12 or 11; anal 1–8 or 9; scales 130 to 140; body brown or mottled, but without crossbands ..... *B. sinensis.*

AA. No ocellus on the caudal base; dorsal IX or X–I–16 or 17; anal I–12; scales 150; body with 8 or 9 dark brown crossbands..... *B. zonatus.*

BOSTRICHTHYS SINENSIS (Lacépède).

In the Philippines this eleotrid, so readily recognized by the large ocellus or "eye-spot" at the base of the tail, is known from Manila Bay, Mindoro, Romblon, Cebu, Busuanga, Mindanao, and the Sulu Archipelago and no doubt is found on all our coasts. First described from the southern coast of China, it is known from the Andaman Islands through the East Indies and Melanesia to Fiji, and east of the Philippines to Kusaie, in the Carolines.

It reaches a length of over 200 mm.

BOSTRICHTHYS ZONATUS (M. Weber).

This species is only known from Merauke, New Guinea. It reaches a length of 150 mm.

6. Genus GRACILEOTRIS Herre

This genus is distinguished by the presence of two large teeth set transversely on the vomer, but fused to form a single incisorlike tooth. The scales are cycloid, 150 to 160 in lateral series, the sides of the head and the predorsal area naked. Dorsal and anal rays each 24 to 30. Fins all low, the caudal a little longer than the head and more or less lunate, its upper and lower rays elongate. The dorsal and anal rays are all simple.

Type of the genus *Gracileotris bockensis* Herre.

GRACILEOTRIS BOCKENSIS Herre.

Thus far this is only known from Bock Island, on the outer reef of Rongerik Atoll, in the Marshall Islands.

This species reaches a length of about 80 mm.

7. Genus ZEBRELEOTRIS Herre

This genus has a low ridge across the vomer, formed of two distinct teeth, and covered with a velum. Dorsal VI–I–10 to 16; anal I–10 to 14; ventral I–4. There are 60 to 75 rows of

ctenoid scales in a longitudinal, and 20 to 26 rows in a transverse series; predorsal scales extend halfway to the eyes; cycloid scales on the pectoral base and preventral area; the head is naked. One or two pairs of canines anteriorly in the upper jaw, 2 pairs of canines in the lower jaw.

Type of the genus *Zebreleotris fasciata* Herre.

ZEBRELEOTRIS FASCIATA Herre.

Only known as yet from Bikini Island, Bikini Atoll. It reaches a length of about 60 mm.

8. Genus GOBIOMORPHUS Gill

Small, stout, short-bodied eleotrids with large scales, rows of skinny papillate ridges on the head, and no teeth on the vomer. Several species occur in Polynesia, Australia, New Zealand, and the East Indies. Two species are known from the Philippines.

Key to the Philippine species of Gobiomorphus

A. Anterior half of body with cycloid scales, posterior half with ctenoid scales; 10 scales, between second dorsal and anal origins.... *G. illotus.*

AA. All scales on trunk ctenoid; 13 scales between second dorsal origin and anal origin ..... *G. sclateri.*

GOBIOMORPHUS ILLOTUS Herre.

As yet this species is only known from Polillo. More material may show it to be but a variant of *G. sclateri.*

GOBIOMORPHUS SCLATERI (Steindachner).

This little reef dweller, which apparently never exceeds a length of 60 mm, occurs throughout the Philippines. In the East Indies it is known from Great Tobea and Tomahu Islands and is common in the New Hebrides, Solomons, Fiji, Samoan, and Society Islands.

9. Genus BUTIS Bleeker

East Indian fishes of salt, brackish, and fresh water living in bays and estuaries, and the lower parts of rivers near the sea. Five species are known from the tropical Indo-Pacific area, of which 3 occur in the Philippines. They are all small slender fishes, never exceeding 150 mm in length. The long pointed prismatic head with prominent bony crests is very distinctive.

Key to the Philippine and East Indian species of Butis

A. Least depth of the caudal peduncle 1.9 to 3 times in its own length.

B. Scales of the trunk with basal accessory scales.

C. Maxillary not reaching eye or scarcely extending beyond anterior margin of eye; 2 or 3 rows of minute scales between eye and orbital ridge; outer row of teeth longer than those of the median

rows; scales ctenoid except on pectoral base and preventral area, which are cycloid; head 2.7 to 3 times in the length *B. butis.*

CC. Maxillary extending beneath middle of eye, teeth all approximately equal in size; all scales ctenoid; head 2.4 to 2.5 times in the length ..... *B. melanostigma.*

BB. No basal or accessory scales on scales of trunk.

D. Interorbital, preopercle, and jaws covered with scales. *B. amboinensis.*

DD. Interorbital, preopercle, and jaws naked..... *B. gymnopomus.*

AA. Least depth of caudal peduncle 1.66 times in its own length; scales ctenoid, those of the head cycloid..... *B. prismaticus.*

BUTIS BUTIS (Hamilton).

This little fish occurs from Cagayan Province, Luzon, to Davao, Mindanao, and Palawan in the Philippines. Originally described from the Ganges River, India, it ranges to the coast of China, and eastward through the East Indies to New Guinea.

BUTIS MELANOSTIGMA Bleeker.

This species is known only from Java, Madura, Sumatra, and Borneo. It probably occurs in the Philippines but has been confused with *Butis butis.*

BUTIS AMBOINENSIS Bleeker.

This small obscure fish, known as *biang sunog,* occurs throughout the Philippines in rivers near the sea. It was first described from Amboina, and is also known from Buru and Celebes. It occurs from the Andaman Islands in the Indian Ocean to New Guinea, the Solomon Islands, the Queensland, Australia.

BUTIS GYMNOPOMUS Bleeker.

In the Philippines this fish is known from Luzon, Mindoro, Panay, and Leyte, and no doubt occurs throughout the Islands. In the East Indies it has been recorded from Sumatra, Nias, Singapore, Banka, Java, and Borneo, and I collected it at Kulambangra Island, one of the Solomon Islands.

BUTIS PRISMATICUS Bleeker.

This species is only known from the vicinity of Surabaya, Java.

BUTIS DASYRHYNCHUS (Günther).

This fish is only known from the rivers of western Borneo. I have seen neither description nor specimens.

10. Genus PRIONOBUTIS Bleeker

This genus is separated at once from its relatives in the genus *Butis* by its teeth and the shape of its head and body. Only two species are known;

A. Eyes 4 to 4.5 times in the length of the head, the concave space between them less than an eye diameter; maxillary extending below the middle of the eye..... *P. koilomatodon.*

B. Eyes very small, about 10 times in the head; interorbital space broad, flat, more than an eye diameter; maxillary extending beyond eye ..... *P. dasyrhynchus.*

DISTRIBUTION OF THE SPECIES OF PRIONOBUTIS

PRIONOBUTIS KOILOMATODON Bleeker.

This species occurs in both fresh and salt water throughout the Philippines, but probably never goes up streams beyond the influence of the tides. It occurs in the East Indies from Celebes and Amboina to Java and is found also at Singapore, Pinang, and the Andaman Islands. It ranges north from the Philippines to the coast of China.

PRIONOBUTIS DASYRHYNCHUS Günther.

This eleotrid is only known from the coast of Sarawak, Borneo, but may well occur in the south-western part of the Philippines.

11. Genus ODONTOBUTIS Bleeker

This genus is separated from *Butis* by its more numerous scales, the increased number of dorsal spines, and the slight development of the smooth and naked bony crests of the head. The head is acute, depressed, each jaw with a few rows of slender teeth; no canines.

Apparently there is but a single species.

ODONTOBUTIS OBSCURA (Schlegel).

Dorsal VII or VIII–I–8; anal I–6 or 7; scales in a lateral series 36 to 46, usually about 40.

The entire body is covered with scales except the space between the eyes and tip of the snout, the lips, eyes, and chin.

The color of preserved specimens is dark brown, with bluntly angled darker crossbands along the sides; all the fins are more or less cross barred with brown and pale spots.

This fish was originally described from Japan, where it is common in estuaries and river mouths. It occurs also in Korea and south along the coast of China to Hong Kong. It has been taken at Zamboanga, and no doubt occurs in river mouths and estuaries throughout the Visayan Islands and Luzon. It has been reported also from Java.

It is a good food fish, reaching a length of 175 mm or more.

12. Genus ODONTELEOTRIS Gill

This genus contains two species, one of which lives in estuaries and mouths of large rivers in Bengal and Burma, and is therefore out of the territory included in this paper. The other is known thus far only from Madura and Java, in the Indies. There are 80 to 100 cycloid scales in a lateral series. The depressed head is densely scaled above and on the sides. The mouth is large, oblique, with prominent lower jaw and two or four prominent curved canines in the upper jaw. Dorsal VI–I–9 to 11; anal I–8 or 9.

ODONTELEOTRIS CANINA Bleeker.

Bleeker had only three specimens from the Straits of Madura, near Kammal, Madura, and from Surabaya, Java. No doubt this fish also occurs in Borneo and should be looked for in the river mouths of Balabac, Palawan, and Mindanao.

13. Genus LIZETTEA Herre

This large robust eleotrid has about 55 ctenoid scales in a longitudinal series, with about 36 predorsal scales. The head is very large and depressed, with projecting lower jaw and very deep caudal peduncle. Dorsal IV or V–I–7; anal I–7. The reduced number of dorsal spines is the outstanding character. Only one species is known.

LIZETTEA PELEWENSIS Herre.

The fins are low, the first dorsal noticeably so. The top and sides of the head are elaborately marked by rows of minute foliose papillæ. The sole specimen is a female 219 mm long, caught in a fresh-water stream in the Pelew Islands. This fish may occur in streams emptying into the Pacific along the coasts of Mindanao, Samar, and Luzon.

14. Genus PALOA Herre

Two species of this interesting genus are known. They are both confined to the Philippines. Dorsal V–I–10 (9 to 12); anal I–8 or 9; scales all cycloid, 85 to 100 in lateral series, 55 to 65 predorsal. Vertical fins are all low, dorsals far apart, the second dorsal and anal much higher than the first dorsal. Eyes noticeably small.

Key to the species of Paloa

A. Scales in longitudinal series 88 to 92; 10 rays in second dorsal; eye more than 10 times in head. A blackish brown stripe from tip of snout above eye to caudal base; a second stripe from eye to middle of caudal base; a third band from pectoral axil to caudal base; no rodlike papillæ on chin under lower jaw..... *P. polylepis.*

AA. Scales in longitudinal series about 100; rays in second dorsal, 9; eye 7.5 times in head; a blackish stripe from snout across eye to caudal base and one from pectoral axil to caudal base; rod-shaped papillæ on chin under lower jaw..... *P. villadolidi.*

PALOA POLYLEPIS Herre.

This strongly differentiated fish is only known from Panay. It is sometimes seen in the Iloilo market, and occurs also in Antique Province. It reaches a length of about 100 mm.

PALOA VILLADOLIDI Roxas and Ablan.

This species was described from Dagupan, Pangasinan Province, and as yet is not known elsewhere.

15. Genus POGONELEOTRIS Bleeker

This genus is unique among the Eleotridæ because of its many short filaments and fringes on the snout and cheeks. Scales ctenoid; the small accessory scales mixed in with the large ones is a character shared with *Butis butis*. Eyes small to minute and widely separated. Two species are known.

Key to the East Indian species of Pogoneleotris

A. Dorsal VI–I–13; anal I–10 ..... *P. heterolepis.*
B. Dorsal VI–I–8; anal I–8 ..... *P. microps.*

CHARACTERS AND DISTRIBUTION OF THE SPECIES OF POGONELEOTRIS

POGONELEOTRIS HETEROLEPIS (Günther).

The broad depressed head is covered with minute scales. The eyes are minute, far apart. Teeth very small, in bands; an outer row of larger teeth in the upper jaw; an outer and inner row of larger teeth in the lower jaw. Only known from Sarawak, Borneo. Reaches a length of 175 mm. After Günther.

POGONELEOTRIS MICROPS M. Weber.

Each scale has 5 small basal scales; all are ctenoid. The eye is 11 times in the head, and 4.4 times in the width of the interorbital. The inner row of teeth is little larger than the rest. Lives in the rivers of both the north and south halves of Dutch New Guinea. Length 230 mm. After Weber.

16. Genus BORODA Herre

Four species are known thus far, three from the Philippines and one from the Sepik River, New Guinea. The New Guinea species is a valuable food fish.

Key to the species of Boroda

A. Predorsal scales 50 or more; lateral scales 62 to 68; eye 8.25 to 11 times in head ..... *B. malua.*

AA. Predorsal scales less than 50; lateral scales 50 to 60; eye less than 6 in head.
B. Transverse scales 17 to 20.
C. Transverse scales 17 or 18; predorsal scales 32 to 34; lateral scales 50 to 52; head 3 to 3.2 times in length; eye 5.2 to 5.5 in head ..... *P. albo-oculata.*
CC. Transverse scales 20; predorsal scales about 42; lateral scales about 60; head 2.4 to 2.7 times in length; eye 4.8 to 5.8 in head ..... *B. expatria.*
BB. Transverse scales 14; predorsal scales 36 to 40; lateral scales about 52; head 2.9 to 3.1 in length; eye 4.3 to 4.5 in head.... *B. francoi.*

DISTRIBUTION OF THE SPECIES OF BORODA

BORODA MALUA Herre.

Only known from the Sepik River, New Guinea. A bulky fish reaching a length of a third of a meter or more.

BORODA ALBO-OCULATA Herre.

A Philippine species occurring in streams in Palawan, Culion, and Busuanga, and in the sea at Nasugbu, Luzon. No doubt occurs in Mindoro. Attains a length of 125 mm or more.

BORODA EXPATRIA Herre.

Occurs in streams and lakes in northern Palawan. It reaches a length of 150 mm.

BORODA FRANCOI Roxas and Ablan.

As yet only collected from the Dagupan River, Pangasinan Province, Luzon.

17. Genus BUNAKA Herre

Large thick-bodied eleotrids living in rivers near the sea. One species is only known from Mindanao, but the other two are not so restricted in their range. One is known from Sumatra and Celebes, but the other ranges all over the Philippines, south into British North Borneo, and eastward through Micronesia.

Key to the species of Bunaka

A. Body uniform brown on back and sides, with dark longitudinal lines along the rows of scales. Lateral series of scales 56 to 60; scales in transverse series 16 to 18 (19).
B. Depth 5.75 to 6, the head 4 times in the length; eye 5 to 5.5 times in the head and equal to, or a little less than interorbital space. *B. gyrinoides.*
BB. Depth 4 to 4.6, the head 2.8 to 3 times in the length; eye 6.5 to 7.5 times in head and 1.75 or more than twice in the interorbital width ..... *B. pinguis.*
AA. Head, sides, and under parts spotted with large irregular pale blotches and circular spots; scales 52, in transverse series 20 to 21. *B. sticta.*

DISTRIBUTION OF THE SPECIES OF BUNAKA

BUNAKA GYRINOIDES (Bleeker).

Described by Bleeker from Sumatra and from Celebes.

BUNAKA PINGUIS Herre.

Largest of the Philippine gobies, reaching a length of about a fourth of a meter, and occurring all over Luzon and southward to Mindanao and Tawi Tawi. This is a good food fish.

I have taken it also at Tawau, on the east coast of British North Borneo, and in the Pelew Islands. Specimens were also sent me from Kusaie, one of the eastern Caroline Islands.

BUNAKA STICTA Herre.

Only known from the Tagaloan River, Misamis Oriental Province, Mindanao. The single specimen known measured 210 mm.

18. Genus OPHIOCARA Gill

The body is robust, more or less rounded anteriorly, with flattened sides toward the tail. The smooth head is broad and flattened, densely scaled, the scales on top of the head enlarged. The scales of the body are ctenoid, with from 28 to 40 in a lateral series. The mouth is large, oblique, the lower jaw prominent; there are 6 to 10 rows of small teeth in each jaw, those of the outer row in each jaw enlarged; there are no canines. Dorsal VI–I–8 or 9; anal I–7 to 9.

Numerous species have been described, mostly based on growth stages, color phases, sexual differences, and other variations. An examination of thousands of specimens over most of the range of the species, living and freshly caught fish, as well as museum specimens, together with the observation of aquarium specimens over a decade, forces me to reduce our species to two. Fishes of this group are desirable food fishes.

Key to the Philippine and East Indian species of Ophiocara

A. Scales about 30 in lateral series; 2 dark diagonal bands from eye to opercle; 13 to 17 predorsal scales; only 2 pores on edge of preopercle, rarely conspicuous ..... *O. aporos.*

AA. 35 to 40 lateral scales; 22 to 26 predorsal scales; 5 preopercular scales, at least 3 of them conspicuous; no diagonal band from eye to opercle ..... *O. porocephala.*

REMARKS UPON AND DISTRIBUTION OF PHILIPPINE AND EAST INDIAN SPECIES OF OPHIOCARA

OPHIOCARA APOROS Bleeker.

This brilliantly colored eleotrid is the handsomest fresh-water fish native to the Philippines. In life its dark green background with golden spots, often varied with red or orange, golden spots on the fins, and markings on the sides of green, violet, or lavender, make it a gorgeously colored fish. While the general pattern is the same, one scarcely finds two alike in details of ornamentation.

The *bañgañgay* is found in lowland streams and lakes throughout the Philippines, and sometimes in the sea. Elsewhere it occurs from Sumatra to New Guinea, Fiji, and the Caroline Islands.

It is an important food fish to the people along rivers and lakes in the interior of Luzon, Mindanao, New Guinea, and other large islands. It is taken in traps, *bobos*, and also with hook and line. It reaches a length of 300 mm, but Philippine specimens have not been seen over 225 mm.

OPHIOCARA POROCEPHALA (Cuv. and Val.).

This fish lacks the brilliant colors of the preceding. It is brown or greenish brown with four broad dusky crossbands over the back and rows of pearly spots along the side, a spot to each scale. Some have two broad pale or yellowish crossbands over the back and down the sides.

It is found throughout the Philippines and East Indies in both fresh and salt water, but is less abundant than *O. aporos*. It ranges from India and the Seychelles Islands to the Caroline Islands and Fiji. The largest specimen seen was 225 mm long, but larger examples have been reported.

19. Genus GIGANTOGOBIUS Fowler

This huge eleotrid, largest of the gobioid fishes, is only known from the Baram River, Sarawak, Borneo.

The body is thick, rounded, robust, with a very large depressed head and a broad depressed snout. The eye is superior and noticeably small. The vertical fins are all unusually low. The whole body, except the snout, jaws, and under side of the head, is covered with small cycloid scales; predorsal scales very small and crowded.

There is but one species known.

GIGANTOGOBIUS JORDANI Fowler.

The head is 3.25 in the length or 2.25 times in the trunk, the depth 3.7 in the length. The eye is 11.6 in the head, and is in the first third of the head length.

The color is dark brown, the fins barred with dark brown spots.

The largest specimen Fowler had was 660 mm long.

20. Genus OXYELEOTRIS Bleeker

Some of the species of this genus are among the largest of all the gobies, and all are esteemed as food. Most of the species are seen regularly in the fish markets of Borneo, Malaya, Thailand, and the villages of New Guinea.

This genus belongs with the other large and bulky eleotrids which are distinguished by the possession of a large, broad, depressed head with a prominent lower jaw. But unlike the rest of them, the head is pointed, with a narrow snout; the others all have a blunt head with rounded snout. Another characteristic feature of *Oxyeleotris* is that the scales are all ctenoid.

DISTRIBUTION OF THE PHILIPPINE AND EAST INDIAN SPECIES OF OXYELEOTRIS

OXYELEOTRIS MARMORATA (Bleeker).

This large handsome eleotrid is common near the sea in the estuaries and rivers of Sumatra, Malaya, Siam, and Borneo. It has been taken from Laguna de Bay, Luzon, and no doubt is in river mouths in Balabac, Palawan, Tawi Tawi, and Cotabato Province, Mindanao. It has been recorded from Celebes and Ternate. It is a thick-bodied bulky fish and one of the largest of gobies, reaching a length of 460 mm or more. It is a good food fish, well known in the markets of Borneo, where living specimens are often seen.

OXYELEOTRIS UROPHTHALMUS (Bleeker).

This attractive looking fish, readily recognized by the ocellus on the caudal base, is often seen in the fish markets of Borneo, Malaya, Siam, and Sumatra, and occurs eastward to Celebes and New Guinea. It has not yet been taken in the Philippines but may well occur in the rivers of the south coast of Mindanao and in Balabac and Palawan. The var. *novæ guineæ* Koumans is only known from the Lorentz River, New Guinea. This fish reaches a length of about 200 mm.

OXYELEOTRIS UROPHTHALMOIDES (Bleeker).

This is another sharply differentiated fish, the spiny first branchiostegal making it easy to recognize. It is found in the lower part of the rivers of Borneo, Malay, and Sumatra and attains a length of 200 mm.

OXYELEOTRIS HETERODON M. Weber.

This large species is only known positively from fresh water in New Guinea. Several species described from Queensland, Australia, may belong here. It reaches a length of 425 mm.

OXYELEOTRIS FIMBRIATUS (M. Weber).

This species, which reaches a length of 300 mm, occurs in rivers and creeks in New Guinea, Waigiu, and the Aru Islands.

21. Genus HERREOLUS H. M. Smith

An interesting group of very small slender eleotrids thus far found only in Thailand and in the Philippines. The ventrals have but three rays and a spine. The naked body is almost translucent, giving one the curious impression of being able to look right through them.

Two species are known. Though apparently rare, I believe that they are comparatively common, but their mode of life protects them from observation. Their favorite abode is around and within the mass of hydroids, sponges, soft coral, tunicates, and algæ which cover piling, wharf timbers, floating logs, rocks, and other exposed surfaces, as well as in coral heads. They never venture far from their protected abode, and scurry back into hiding at the slightest alarm.

Key to the species of Herreolus

A. Second dorsal I–13 to 16; anal I–12 to 15; a broad black stripe extends from the lower jaw across the eye to the caudal tip.... *H. formosus.*

AA. Second dorsal I–18; anal I–17 or 18; no longitudinal stripe, but a black spot nearly equal to eye on caudal peduncle at the caudal base ..... *H. philippinus.*

DISTRIBUTION OF THE SPECIES OF HERREOLUS

HERREOLUS FORMOSUS H. M. Smith.

This pretty little fish was first known from the Gulf of Siam. In the Philippines it may be seen darting out from under the growth covering piling and wharf timbers at Cebu, Dumaguete, and elsewhere in the Visayas and the coast of Mindanao. By using a long-handled dip net I have taken it at Dumaguete and at Port Holland, on the coast of Basilan. They never venture

far from their protected home, and though many are seen it is very difficult to get any.

HERREOLUS PHILIPPINUS Herre.

Thus far this species is only known from Santa Maria, Zamboanga Province, Mindanao. They were observed swimming about under a large log raft in front of the saw mill at Santa Maria. They swam about in small schools, never going far from between the logs, but I was able to secure a few. No doubt they occur all around the Sulu Sea in suitable localities.

Neither species is known to exceed 30 mm in length, and most of them are 20 to 25 mm long.

22. Genus ANDAMELEOTRIS Herre

Dorsal VI–I–15 to 17; anal I–15 to 18; ventral I–3. The cycloid scales are 75 to 100 in longitudinal and 20 to 24 in transverse series.

Head naked, snout very short, mouth nearly vertical. The caudal maybe bluntly rounded, truncate, or forked.

Very small fishes related to *Ptereleotris*. Two species are known, one from the Andaman Islands and one from the Philippines. Their lengths are from 15 to 25 mm.

Key to the sepcies of Andameleotris

A. Uniform brown with black circular spot on lower half of caudal; other fins unmarked; caudal bluntly rounded..... *A. palustris.*
Known only from a nipa swamp near Zamboanga, Mindanao, Philippines.

AA. Tan, with a darker band from axil to caudal; a circular reddish black spot on caudal base; dorsal and anal spotted; caudal with reddish longitudinal band above and below; caudal truncate or more or less forked ..... *A. raoi.*
Only known from the Andaman Islands in the Indian Ocean.

23. Genus EVIOTA Jenkins

Their peculiar long narrow and more or less sickle-shaped ventrals with fringed rays, together with their minute size, serve to set apart the fishes of this group and make it an easy one to recognize. The head and body are naked as far back as the first dorsal. The large eyes are much longer than the snout. Dorsal VI–I–8 to 10; anal I–7 to 9; ventral I–4.

Some species of this genus are among the smallest living backboned animals. Owing to their habit of life and their minute size they are little known. They live in the intricate crevices of coral where they cannot be obtained by ordinary means. The best way of getting them is to get coral masses by diving,

then break up the coral heads over a canvas, so the tiny fish will not be lost.

The members of this genus are abundant in the coral reefs of Polynesia and range through the East Indies and Philippines north to southern Japan. A dozen or more species are known, but only three are known from the Philippines.

Key to the Philippine and East Indian species of Eviota

A. Scales 22 in lateral series; 8 dark bands on dorsal and ventral surfaces of body ..... ***E. sealei.***

AA. Scales more than 22.

B. Scales 24; two circular black spots on pectoral base; the first 2 dorsal rays elongate and threadlike ..... *E. distigma.*

BB. Scales 25; 8 dark spots along side..... *E. gymnocephalus.*

DISTRIBUTION OF PHILIPPINE AND EAST INDIAN SPECIES OF EVIOTA

EVIOTA SEALEI Herre.

This tiny species is known from Puerto Galera, Mindoro, from Dumaguete, Busuanga, Culion, and Bongao, Sulu Province. It occurs, no doubt, on coral reefs throughout the Philippines. Specimens seen were 12 to 17 mm in length.

EVIOTA DISTIGMA Jordan and Seale.

The two-spot *Eviota* is widespread in Polynesia and has been taken in the East Indies and at Dumaguete. It is so small and hides in coral so successfully that it is not easily found but is probably as common in the Philippines as Seale's *Eviota*. The two-spot *Eviota* is from 12 to 18 mm in length.

EVIOTA GYMNOCEPHALUS Weber.

Weber's *Eviota* is widespread in the East Indies and has been taken near Tawi Tawi, Sulu Province. It reaches a length of 25 mm.

24. Genus LUZONELEOTRIS Herre

This dwarf *Eleotris* seems to be allied to *Pterocliops* and *Orthostomus*. Only one species known.

LUZONELEOTRIS NASUGBUA Herre.

Scales cycloid anteriorly, ctenoid behind tip of pectoral, 48 to 50 in longitudinal series, sides of head and nape scaled. Dorsal VI–I–12; anal I–10; ventral I–5. Gill opening very wide, extending forward beneath middle of eye. Tongue truncate. Caudal with a rounded point, a little longer than the head. Body slender, elongate, compressed, the rather small head de-

pressed anteriorly. The eye is half again as long as the snout.

Only known from a female specimen 24 mm long, ready to spawn, taken from a tide pool at Nasugbu, Batangas Province, Luzon.

25. Genus VALENCIENNEA Bleeker

This genus contains five or six species of slender, elongate, handsome, agile reef fishes of the Philippines, East Indies, and tropical Indo-Pacific in general.

Dorsal VI–I–11 to 18; anal I–12 to 17; ventrals I–5; scales ctenoid, 70 to 110 in a longitudinal series. First dorsal higher than second dorsal, the spines in some species elongate with threadlike tips.

This group includes some of the most beautiful of the eleotrids.

Key to the Indo-Pacific species of Valenciennea

A. Scales in lateral series more than 100.
  B. Second dorsal and anal with 16 to 18 rays. Scales 105; a pearly blue band from the angle of the mouth below the eye to the opercle; caudal bluntly rounded ..... *V. strigata.*
  BB. Second dorsal and anal with 11 to 14 rays.
    C. Scales about 130; caudal obtusely rounded, with two rays nearest the 3 middle ones elongated and threadlike..... *V. helsdingeni.*
    CC. Scales 105 to 110; five large ocellated spots on the side; no caudal rays prolonged and threadlike ..... *V. longipinnis.*
AA. Scales 90 or less.
  D. Scales 80 to 90; teeth in upper jaw in one row; maxillary extending to the front margin of the eye or slightly beyond; sides of head with 3 or 4 longitudinal roseate bands; 2 or 3 similar bands on upper half of trunk, with sometimes vertical red bands crossing them at right angles..... *V. muralis.*
  DD. Scales 75 to 85; teeth in upper jaw in 2 rows; maxillary reaching below the middle of the eye or beyond; 6 (5 to 9) violet ocelli or spots on sides of head..... *V. sexguttata.*

DISTRIBUTION OF THE SPECIES OF VALENCIENNEA

VALENCIENNEA STRIGATA (Broussonet).

This trim beautiful fish occurs throughout the East Indies and Philippines, but the only published Philippine records are from Sorsogon Province, Luzon, and Dumaguete. It is abundant in the Caroline and Marshall Islands, and ranges to Tahiti. It reaches a length of 150 mm. The band across the cheek is very distinctive.

VALENCIENNEA HELSDINGENI Bleeker.

This lovely fish was only known from Goram, in the East Indies, until recently, when Dr. J. L. B. Smith figured and described it from Delagoa Bay, South Africa.

VALENCIENNEA LONGIPINNIS (Bennett).

This is another eleotrid of great beauty. It was first described from the Riu Kiu Islands. In the Philippines it is known from Siquijor Island, the coast of Leyte, and the Sulu Islands. Elsewhere it occurs from Celebes to the Fiji Islands. It reaches a length of 140 mm or more.

VALENCIENNEA MURALIS (Quoy and Gaimard).

This is the commonest and most widespread member of the genus. It is abundant in the Philippines, from Luzon to Balabac, Sitankai, and Davao. It is common from India and Ceylon through the East Indies to Australia, Fiji, and the Caroline Islands, and ranges north to Japan. Attains a length of 125 mm.

VALENCIENNEA SEXGUTTATA Bleeker.

This pretty little fish ranges through the East Indies and the Visayan Islands and probably occurs on reefs throughout the Philippines. It occurs in Polynesia as far as Samoa, where it is common. It reaches a length of about 125 mm.

26. Genus PTEROCULIOPS Fowler

This genus is related to *Valenciennea*, having two pairs of canines in the upper jaw and one pair in the lower, but differs in having larger scales; these are finely ctenoid, about 64 in lateral and 19 in a transverse series; predorsal scales 15 to 20, the head otherwise naked. Mouth large, extending below the eye; tip of tongue rounded. Dorsal VI–I–11; anal I–12; ventral I–5. Ventrals very long, longer than the head. Head and body with many rounded, blue-gray spots variable in size, more or less ringed with darker brown. Only one species is known.

PTEROCULIOPS GUTTATUS Fowler.

Only the type, 69 mm long, is known. It was taken at Port Banalakan, Marinduque.

27. Genus AMBLYELEOTRIS Bleeker

The anterior scales are cycloid, those on the posterior half ctenoid, 75 to 85 in a longitudinal series. The blunt head is naked, without predorsal scales. The dorsals are close together; dorsal and anal rays 12 or 13; ventral I–5. Three pairs of canines in the lower jaw.

AMBLYELEOTRIS PERIOPHTHALMUS Bleeker.

This is a rare species, only known from two specimens. Bleeker had one of 75 mm, taken at Batavia, now Djakarta, Java. Dr. Weber took one of 45 mm at Nusa Laut, in the

Molukkas. This fish should be looked for on the south coast of Mindanao, and in the Sulu Islands, as these localities have practically all marine fishes occurring in the Molukkas and on the coast of Celebes.

28. Genus Nemateleotris Fowler

Dorsal VI–I–28; anal I–24; ventral I–5; first dorsal spine prolonged into a thread reaching to the base of the last dorsal ray. Scales 100 to 110, plus 10 more on caudal base. Eye large, 3 times in head, much longer than snout. Teeth strong, in a single row about 20 in each jaw.

Only one species is known.

NEMATELEOTRIS MAGNIFICUS Fowler.

Known from a single specimen 61 mm long, taken at Buka Buka Island, Gulf of Tomini, Celebes.

29. Genus PARVIPARMA Herre

Body elongate, subcylindrical, the dorsal and ventral profiles nearly straight and parallel. Body covered with minute cycloid scales, more or less embedded, and 165 in lateral and 40 in transverse series; minute scales on pectoral and caudal fins and on nape above opercle; rest of head naked, the cheeks with crisscross lines of papillæ. Mouth nearly vertical with several rows of minute teeth behind an outer row of larger conical teeth; a pair of canines behind other teeth on each side of median line in upper jaw; lower jaw has 4 large coarse teeth on each side of the symphysis. Dorsal VI–I–10; anal I–10; ventral I–5; vertical fins all low; caudal rounded, equal to head. Only one species is known. It occurs in fresh and brackish water.

PARVIPARMA STRAMINEA Herre.

This Philippine eleotrid, which reaches a length of 85 mm, has been taken at Aparri, on the north coast of Luzon, and from the Saug River, on the south coast of Cotabato Province, Mindanao.

30. Genus PTERELEOTRIS Gill

This readily recognized genus contains only four species, all living in the waters of the western Pacific. It is the only genus with the ventrals I–4 which has a lunate caudal.

The members of this genus have been called pelagic because they have been taken while swimming at the surface. As a matter of fact various gobioid and blenniid fishes leave their haunts on the bottom and come to the surface at night, returning

afterward to their homes below unless carried away by strong tidal currents. They are in no true sense pelagic fishes.

Key to the western Pacific species of Ptereleotris

A. Dorsal and anals rays 24 to 25.
  B. No black spot on lower part of caudal base ..... *P. dispersus.*
  BB. A black spot on lower part of caudal base..... *B. evides.*
AA. Dorsal and anal rays 28 or more.
  C. Dorsal and anal rays 28 to 29; pectoral base with oblong blackish spot; caudal without a black spot or band..... *P. microlepis.*
  CC. Dorsal and anal rays 30 to 32; no blackish spot on pectoral base; central part of caudal black..... *P. heteroptera.*

DISTRIBUTION OF THE SPECIES OF PTERELEOTRIS

PTERELEOTRIS DISPERSUS Herre.

This Philippine species occurs from the Batanes Islands in the extreme north to the south coast of Mindanao. Not known elsewhere. It gets to be more than 80 mm long.

PTERELEOTRIS EVIDES Jordan and Hubbs.

This species, originally described from Japan, ranges to the New Hebrides. It reaches a length of 55 mm or more.

PTERELEOTRIS MICROLEPIS (Bleeker) Gill.

This eleotrid was first described from Nias and Banda Neira, islands in the East Indies. It is also known from Zanzibar, off the East Coast of Africa. It attains a length of 120 mm. It may well occur in the Sulu Archipelago and along the south coast of Mindanao.

PTERELEOTRIS HETEROPTERA Bleeker.

This is only known from a single specimen 49 mm long, taken at Bandjermasin, Borneo.

31. Genus POGONOCULIUS Fowler

This genus is separated at once from all other eleotrids in the Oriental tropics by the presence of a barbel on the middle of the chin under its tip. Dorsal VI–I–27; anal I–25; ventral I–4. The body is elongate, greatly compressed, the head small and short. The mouth is nearly vertical, with 10 large conical teeth in each jaw. Caudal truncate. The minute scales are only distinct on the tail. Ventrals equal to head and much longer than the pectorals. But one species is known.

POGONOCULIUS ZEBRA Fowler.

A single specimen 95 mm long was collected at Dasol Bay, Pangasinan Province, Luzon. The color was brown, with numerous narrow pale brown crossbands, narrower than the

dark interspaces; there were 21 crossbands on the type specimen.

31. Genus VIREOSA Jordan and Snyder

The greatly elongate compressed body is covered with minute cycloid scales, separated and partly embedded; head naked, eyes large, more than the snout. A long flat barbel on chin, followed by three smaller ones. Dorsal VI–I–24; anal I–24; ventral I–4. Gill openings wide, extending forward below. Caudal long, the upper and lower rays extended in long, ribbon-like filaments. Only one species is known.

VIREOSA HANAE Jordan and Snyder.

This marine eleotrid is only known positively from Japan. It reaches a length of 130 mm. It may well occur in the Batanes Islands.

33. Genus ORTHOSTOMUS Kner

The body is elongate and compressed, the blunt head truncate, the small ctenoid scales extending forward to the eyes. The mouth is nearly vertical, with strong curved canines in both jaws. There are 25 to 30 rays in both the second dorsal and anal. The caudal fin is bluntly convex. Only one species is known.

ORTHOSTOMUS AMBLYOPINUS Kner.

Only one specimen, about 65 mm long, is known. It was taken at Singapore. This fish should occur along the China Sea coasts of Balabac, Palawan, and the Calamianes.

34. Genus OXYMETOPON Bleeker

This unique genus contains but a single known species. There are 100 to 110 ctenoid scales in a lateral series, but they fall off so freely that the fish may appear to be naked. There are 30 to 32 dorsal and anal rays. The elongate caudal fin has its central rays prolonged and threadlike. Other notable characters are the greatly compressed body, the height of the crest or keel before the dorsal, the 4 curved canines in the upper jaw and the two post symphysial canines in the lower jaw, and the 4 rays of the ventral.

OXYMETOPON TYPUS Bleeker.

The only specimen on record is one 159 mm long, taken at Kupang, Timor. It was rose-colored, with two diagonal blue streaks on the cheek, three or four blue longitudinal lines on the dorsal fins, a violet anal fin, and bluish ocelli on the caudal.

This lovely fish no doubt occurs in other parts of the East Indies and may well be in the Philippines in the Sea of Celebes.

A REVISION OF THE PHILIPPINE MYCTOPHIDÆ [1]

By Artemio M. Sarenas
Ichthyologist, Bureau of Fisheries, Manila.

TWO PLATES AND TWELVE TEXT FIGURES

INTRODUCTION

Myctophidæ, although undoubtedly a very large family, is one of the least known of the families of fishes included in the order Iniomi. These are commonly known as lantern fishes and are related to the Isospondylous or soft-rayed fishes. Locally, they are called *tingin* (Batangas), *sirum-sirum* (Bicol), and *tirong* (Zambales). The latest published works on myctophids describe approximately 170 valid species. However, nobody knows the exact number since numerous sections of the family are in great need of revision. According to Dr. Rolf L. Bolin, who is presently working on a monograph of the Myctophidæ of the world, the number of species will total considerably more than 200, after the family has been completely studied.

Fraser-Brunner (1949) claims that the original center of dispersal for the family appears to be in the Antartic region, as evidenced from the fact that many of the primitive forms are found there in comparative abundance and that there are fewer species of the family recorded from the northern hemisphere than from the southern.

At present there are too many gaps in the knowledge of a reliable general picture of their bionomics and distribution that the true economic value of the myctophids, except as food of other fishes, remains somewhat a mystery. However, there have been reports that fishermen in the Bicol regions, Zambales, and the Ilocos provinces, catch some species of myctophids in great quantities during certain seasons of the year. While some are being utilized as food prepared like the *dilis* (Engraulidæ), a fairly large amount is being dried and prepared as fish meal, especially for poultry feed.

Myctophids are fairly abundant in Philippine waters, but are rarely caught by fishermen except when they are attracted by light at night in the open seas. Consequently, they are most often regarded as deep-sea fishes. They have been observed to frequent the upper layers of the oceans, even the surface,

[1] Done at Hopkins Marine Station, Stanford University, California, USA., in partial fulfillment of the requirements for the degree of Master of Arts (Biol. Sci.), 1951.

especially at night. Fraser-Brunner stated that "very likely the restriction is effected through the food-chain among the plankton upon which the myctophids feed."

During the Tuna Investigation conducted by the U. S. Fish and Wildlife Service in the Philippine waters, numerous dip-net collections were made of marine animals which had been attracted by light hung over the side of the research vessels. This paper reviews the Myctophidæ taken at these night-light stations. There were more than 1,600 specimens in the collections and these had been captured at 86 different stations, most of them rather evenly distributed throughout the Sulu and Celebes Seas, but a few of them in the China Sea, Pacific Ocean, and in the inland waters (Visayan Islands).

The Philippine members of this family have never been the object of a special study and are poorly known. Roxas and Martin (1937) list 36 species of Myctophidæ as known from the Philippines. This list is evidently based entirely upon a perusal of the literature and has unknowingly perpetuated the errors of the previous workers which provided the source material. For example, the species now known as *Benthosema pterota* is listed twice under the names *Myctophum pterotum* and *M. gilberti*; likewise *Lampanyctus niger* appears under two separate names, viz. *Myctophum nigrum* and *Nannobrachium nigrum*. How many comparable errors are included can not be determined at the present time.

Out of the eleven species reported upon in the present work, six were previously reported by Herre (1950) but without description. These species were taken from the same collection I worked with and referred to Doctor Bolin for identification. I have no illusions that the eleven species constitute even an approximately complete list of forms found in the area, but taken at the surface at night and most of the species in considerable numbers, it might be supposed that these are the forms that would most frequently fall into the hands of general collectors. They are here dealt with as a complete geographic complex so that a firm basis may be established, to which other deep-sea or rare species may be added in the future.

Some species of lantern fishes present great difficulties in determination, especially those that belong to closely related aggregates of species. This is partially due to the briefness and inadequacy of many current descriptions. The author,

therefore, adopted the pattern of Bolin (1939) in taking measurements. All measurements were made with a pair of dividers and were recorded in tenths of millimeters. Measurements of less than 20 millimeters were made under a dissecting microscope. The permillages were calculated mathematically. In an attempt to determine the normal limits of variation, measurements were made upon all specimens which were in suitable condition. The initial values given in the lists of measurements are the arithmetical means of all specimens measured; the values included in parentheses are the extremes.

The standard length is measured from the tip of the snout to the end of the hypural. The latter point, readily seen in small semi-transparent specimens, may be determined with fair accuracy in large individuals by bending the caudal fin from side to side and noting the position of the abrupt wrinkle formed at the base of the rays. The length of the head is measured from the tip of the head to the extreme posterior margin of the opercular flap. The diameter of the orbit is the horizontal distance between opposite margins of the socket. The length of the maxillary is measured from the tip of the upper jaw to the posterior end of the maxillary. The distance from dorsal to ventral is measured from the base of the first dorsal to the base of the first ventral ray; the distance from dorsal to anal, from the same point to the base of the first anal ray. The depth of the caudal peduncle is its least vertical depth.

The distances from the snout to the various fins are measured from the tip of the snout to the bases of the anterior dorsal and anal rays, the upper pectoral ray and the outer ventral ray. In the descriptions, the locations of the fin insertions are given in such terms as "ventral base midway between pectoral base and dorsal origin." In these cases, it is to be understood that the outer ventral ray is midway between the *vertical of* the upper pectoral ray and the *vertical of* the first dorsal ray. Similarly, photophores said to be "above" other organs are merely above the level of these organs unless definitely stated to be directly above them. The lengths of the dorsal and anal bases are measured from the anterior edge of the first ray to the posterior edge of the last ray.

The terminology and abbreviations established by Brauer (1906) and adopted by Parr (1928), and the additional ones introduced by Tåning (1928) and Bolin (1939), have been applied. The general position of the various organs is indicated

on the diagram of a hypothetical myctophid in which all of the photophores are present (Fig. 1).

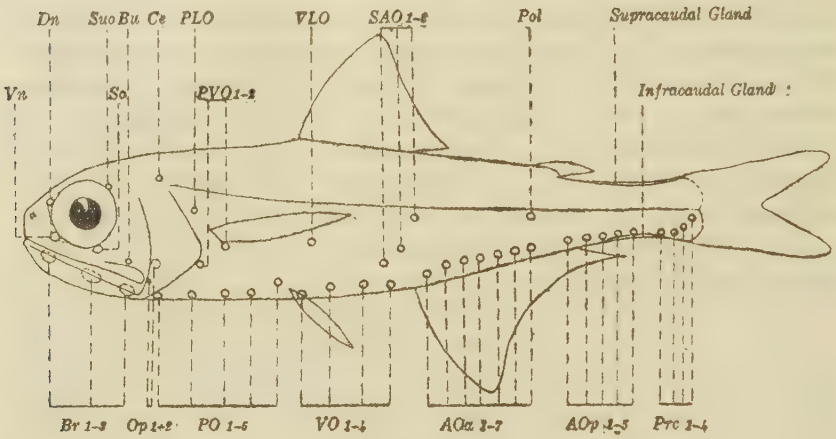


FIG. 1

While no complete synonymies are presented, an attempt has been made under each species to include the references which originally described the fish or introduced each new name; all papers which deal with the Myctophidæ of the world, and the paper which carries the best description and best figure.

To Dr. R. L. Bolin of Stanford University, I am indebted for encouragement, criticism, and for unselfishly contributing some of his ideas and giving me a free access to his personal references and unpublished papers.

I wish to express my sincere thanks to Mr. H. W. Terhune and his staff of the U. S. Fish and Wildlife Service stationed in the Philippines, especially to Mr. H. E. Warfel who not only suggested the subject of this investigation but also provided me with specimens and necessary data.

To Dr. H. W. Graham and Mr. I. A. Ronquillo, I am also indebted for data. My sincere appreciation goes to Mr. J. C. Marr and his staff of the South Pacific Investigations, U. S. Fish and Wildlife Service; Stanford University, for numerous privileges and courtesies. Finally to Director D. V. Villadolid of the Bureau of Fisheries, I wish to extend my gratitude for his encouragement regarding the publication of this work.

A list of the station records and maps (Plates 1 and 2) showing their location is presented below together with a table indicating the species taken at each station.

Station number	Date	Time	N. lat.	E. long.	T. °C.	Sal. parts permille
B- 17	7 to 8/10/47	2345-0100	10° 13′	121° 20′	28.99	33.84
B- 21	8/10/47	2015-2230	09° 03′	122° 31′		
B- 25	9 to 10/10/47	2330-0100	07° 27′	121° 43′	29.36	33.93
B- 26	10/10/47	1905-2000	07° 04′	121° 35′	29.85	33.84
B- 27	11/10/47	0030-0230	07° 45′	121° 45′	29.25	33.84
B- 29	11 to 12/10/47	1945-2030	08° 57′	120° 15′	29.14	33.49
B- 31	12 to 13/10/47	2340-0055	09° 31′	119° 40′	28.72	33.51
B- 35	13/10/47	1950-2115	09° 44′	120° 38′	28.76	33.57
B- 48	4/12/47	0045-0210	08° 28′	119° 34′	28.53	33.58
B- 50	4/12/47	1815-1950	07° 16′	120° 45′	28.98	33.06
B- 51	4 to 5/12/47	2308-0110	06° 52′	121° 03′	28.70	33.08
B- 54	5/12/47	2120-2315	06° 44′	120° 06′	29.08	33.24
B- 57	6/12/47	2010-2120	08° 32′	118° 20′	28.75	33.96
B- 64	10/12/47	1830-1950	06° 49′	118° 52′	28.58	33.49
B- 65	11/12/47	0145-0240	05° 58′	119° 09′	28.63	33.13
B- 67	11/12/48	1900-2215	04° 38′	119° 30′		
B- 93	18/2/48	1830-2200	07° 43′	122° 05′		
B-101	23/2/48	1830-1955	07° 00′	123° 49′	27.94	34.18
B-102	24/2/48	0250-0530	06° 00′	124° 00′	28.65	34.05
B-127	3/3/48	1800-1945	04° 00′	125° 00′	27.49	34.40
B-128	4/3/48	0145-0385	04° 00′	124° 00′	27.98	34.25
B-131	4/3/48	2000-2145	02° 00′	124° 00′	28.20	33.93
B-135	7/3/48	2215-0020	02° 00′	123° 00′	28.59	33.87
B-139	9/3/48	2455-0200	05° 00′	123° 00′	27.90	34.25
B-141	9/3/48	1840-2030	06° 00′	123° 00′	28.77	34.13
B-152	9/4/48	2105-2245	02° 00′	122° 00′	28.83	34.31
B-156	10/4/48	2085-2230	02° 00′	121° 00′	29.24	34.22
B-160	12/4/48	0015-0150	03° 00′	120° 00′	28.78	34.27
B-163	12/4/48	0630-2230	01° 00′	120° 05′	29.71	34.07
B-164	13/4/48	0415-0525	0° 55′	119° 08′	28.86	33.66
B-167	13 to 14/4/48	2350-0200	03° 00′	119° 00′	29.26	34.34
B-171	15/4/48	0200-0350	04° 00′	120° 00′	28.68	34.29
B-177	16/4/48	2130-2315	05° 00′	120° 30′	28.90	34.23
B-178	17/4/48	0320-0514	05° 05′	121° 45′	28.52	34.34
B-183	19/4/48	0130-0430	05° 12′	121° 57′	28.57	34.29
B-209	13/5/48	1000-0100	06° 45′	125° 37′		
B-243	15/6/48	2025-2105	11° 41′	121° 10′	30.00	34.11
B-244	16/6/48	0235-0400	11° 45′	121° 48′	29.88	34.11
B-248	16/6/48	2115-2220	10° 17′	121° 49′	30.35	34.20
B-253	17/6/48	2210-2320	08° 43′	122° 40′	30.11	34.09
B-264	20/6/48	2140-2300	09° 27′	120° 55′	29.49	34.14
B-265	21/6/48	0445-0535	10° 03′	120° 21′	29.37	34.16
B-270	21/6/48	2230-2330	09° 31′	119° 40′	29.57	34.29
B-276	22/6/48	2110-2215	08° 57′	120° 15′	29.51	34.14
B-279	24/6/48	2215-0030	07° 52′	120° 10′	29.57	34.09
B-295	10/7/48	2300-0025	05° 57′	119° 56′	29.01	34.09
B-296	11/7/48	0435-0535	05° 53′	119° 23′	28.85	33.96
B-300	12/7/48	0255-0320	07° 27′	118° 15′	29.21	32.63
B-312	15/7/48	2005-2115	07° 57′	118° 55′	29.07	33.62
B-313	16/7/48	0255-0415	07° 21′	119° 31′	28.78	33.64
B-326	30/7/48	0415-0645	05° 23′	121° 00′	28.99	34.05
B-330	30/7/48	2005-2125	04° 45′	119° 53′	29.23	34.09
B-335	1/8/48	0150-0235	03° 00′	118° 15′	28.90	34.05
B-339	1 to 2/8/48	2345-0145	01° 00′	119° 08′	28.56	33.91
B-342	2/8/48	1950-2130	02° 00′	120° 00′	29.50	34.09
B-343	3/8/48	0400-0545	02° 56′	120° 00′	29.32	34.18
B-345	3/8/48	1830-2045	04° 00′	121° 00′	29.79	34.16
B-349	4/8/48	2020-2140	01° 32′	120° 59′	29.87	34.04
B-353	5/8/48	2150-0030	03° 00′	122° 00′	29.34	34.23
B-375	4/9/48	2055-2315	07° 00′	123° 49′	28.67	33.46
B-379	5/9/48	2335-0240	05° 00′	125° 00′	28.54	34.25
B-383	6/9/48	1930-2115	05° 00′	126° 00′	28.73	34.27
B-388	7/9/48	1930-2045	06° 44′	125° 46′	28.99	33.86
B-396	10 to 11/9/48	2340-0150	02° 00′	126° 00′	27.67	34.13
B-399	11/9/48	1755-1940	03° 00′	125° 00′	29.23	34.22
B-400	12/9/48	0240-0430	04° 00′	125° 00′	28.86	34.27
B-403	12/9/48	2055-2350	03° 00′	124° 00′	28.95	34.16
B-407	13 to 14/9/48	2325-0040	01° 13′	123° 00′	28.76	34.16
B-484	21/1/49	1935-2105	13° 35′	120° 07′	26.84	33.49
B-488	22/1/49	1900-1946	13° 16′	120° 21′	26.76	33.51

Station number	Date	Time	N. lat.	E. long.	T. °C.	Sal. parts per mille
B-490	23/1/49	0045-0250	12° 50′	120° 37′	26.72	33.49
B-494	24/1/49	0115-0215	12° 24′	120° 53′	26.49	33.64
B-499	24/1/49	2130-2310	11° 43′	121° 48′	25.74	33.93
B-504	26/1/49	0315-0300	09° 49′	119° 23′	26.98	33.75
B-507	28/1/49	0015-0400	07° 43′	120° 29′	27.40	33.82
B-517	31/1/49	1920-2220	08° 06′	116° 07′	26.45	33.37
B-522	2/2/48	0105-0246	10° 25′	117° 46′	26.92	33.21
B-560	19/2/48	1830-1915	10° 40′	124° 33′	26.36	34.04
B-576	24/2/48	0125-0240	12° 30′	122° 55′	26.31	34.18
G- 52	10/4/48	0900-1530	06° 33′	122° 18′	------	-------
G- 53	10/4/48	1930-0100	06° 31′	122° 12′	------	-------
G- 62	26/4/48	1900-2230	05° 50′	120° 39′	------	-------
G- 65	3/5/48	1900-2300	05° 59′	120° 38′	------	-------
G- 66	4/5/48	1900-2200	05° 29′	119° 54′	------	-------
G- 82	1to2/7/48	1830-2200	13° 22′	124° 44′	------	-------
G- 83	2to3/7/48	1900-2300	13° 22′	124° 40′	------	-------

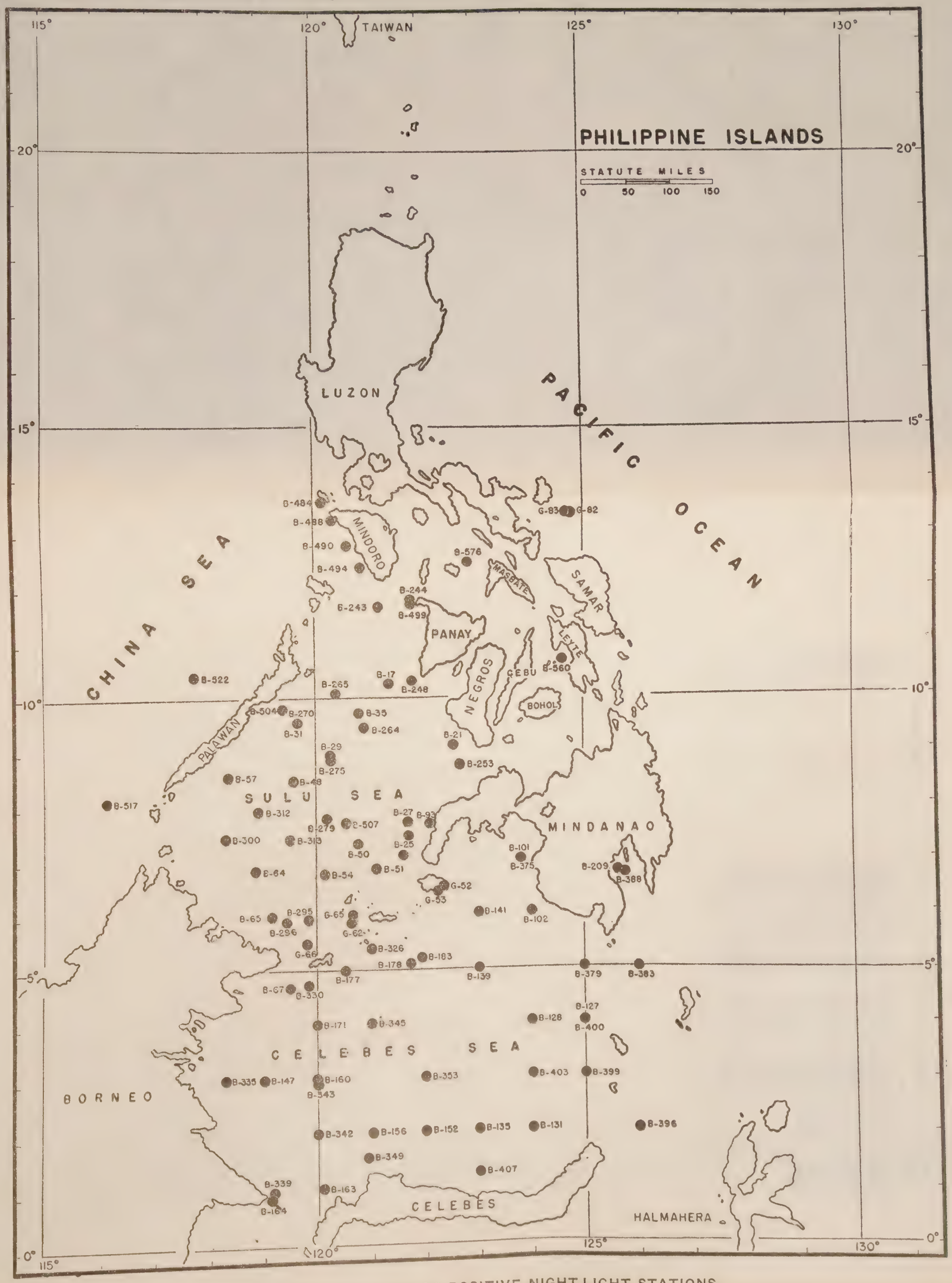


PLATE 1. LOCATION OF POSITIVE NIGHT-LIGHT STATIONS.

PHILIPPINE FISHERY PROGRAM

PLOTTING CHART Nº 3

SULU SEA, CELEBES SEA, AND EAST OF MINDANAO

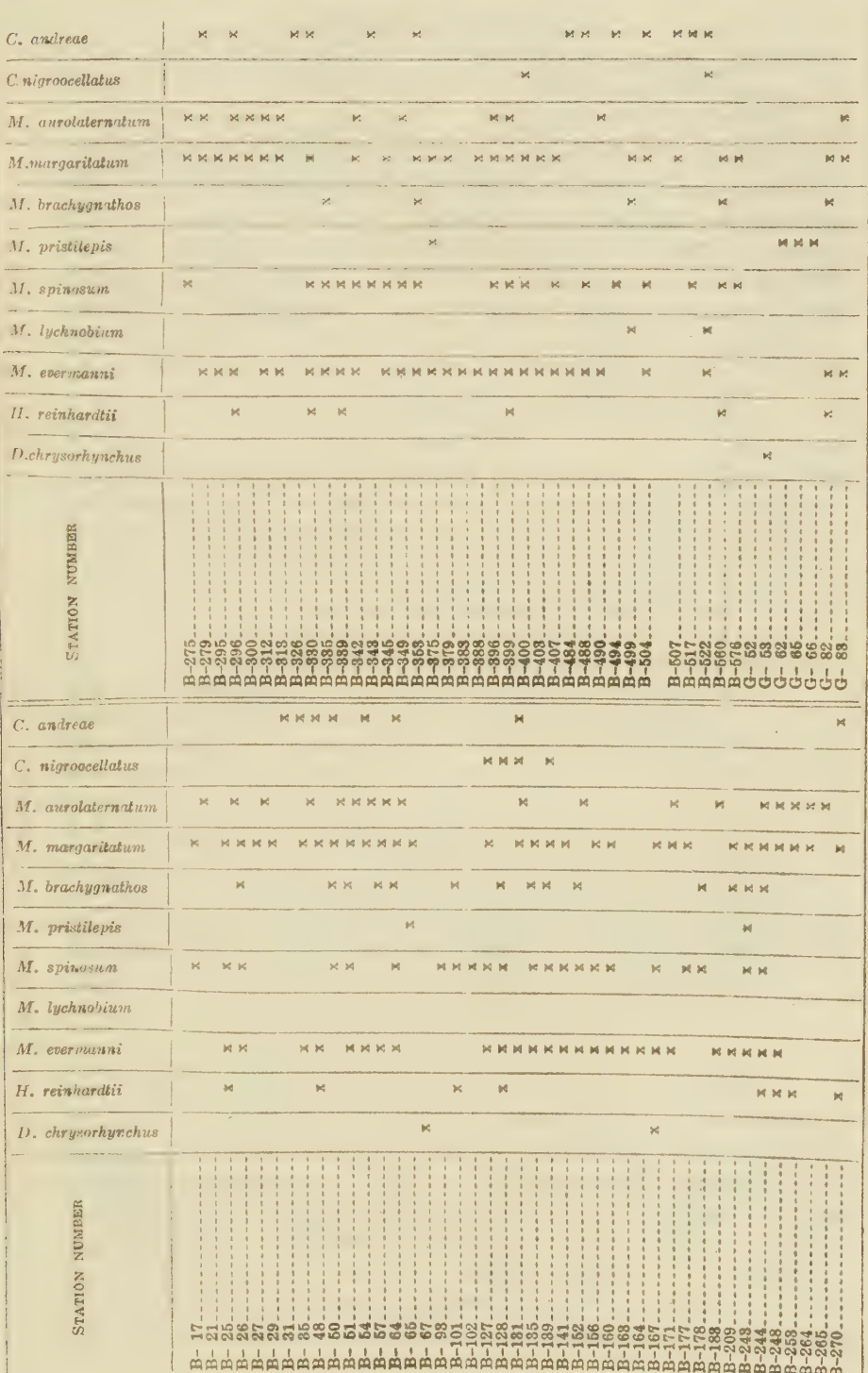
MAP SHOWING LOCALITY RECORDS OF EACH SPECIES

LEGEND

1. *Centrobranchus andreae*
2. *Centrobranchus nigroocellatus*
3. *Myctophum aurolaternatum*
4. *Myctophum margaritatum*
5. *Myctophum brachygnathos*
6. *Myctophum pristilepis*
7. *Myctophum spinosum*
8. *Myctophum lychnobium*
9. *Myctophum evermanni*
10. *Hygophum reinhardtii*
11. *Diaphus chrysorhynchus*

MANILA
MINDORO
MASBATE
SAMAR
LEYTE
PANAY
NEGROS
CEBU
BOHOL
MINDANAO
DAVAO
PALAWAN
BORNEO
CELEBES
HALMAHERA

PLATE 2. SHOWING LOCALITY RECORDS OF THE DIFFERENT SPECIES.


C. andreae
C. nigroocellatus
M. aurolaternatum
M. margaritatum
M. brachygnathos
M. pristilepis
M. spinosum
M. lychnobium
M. evermanni
H. reinhardtii
D. chrysorhynchus
STATION NUMBER
B-275 B-279 B-295 B-296 B-300 B-312 B-313 B-326 B-330 B-335 B-339 B-342 B-343 B-345 B-349 B-363 B-375 B-379 B-383 B-388 B-396 B-399 B-400 B-403 B-407 B-484 B-488 B-490 B-494 B-499 B-504 B-507 B-517 B-522 B-660 B-676 G- 52 G- 53 G- 62 G- 66 G- 66 G- 82 G- 83
C. andreae
C. nigroocellatus
M. aurolaternatum
M. margaritatum
M. brachygnathos
M. pristilepis
M. spinosum
M. lychnobium
M. evermanni
H. reinhardtii
D. chrysorhynchus
STATION NUMBER
B- 17 B- 21 B- 25 B- 26 B- 27 B- 29 B- 31 B- 35 B- 48 B- 50 B- 51 B- 54 B- 57 B- 64 B- 65 B- 67 B- 93 B-101 B-102 B-127 B-128 B-131 B-135 B-139 B-141 B-152 B-156 B-160 B-168 B-164 B-167 B-171 B-177 B-178 B-183 B-209 B-243 B-244 B-248 B-258 B-264 B-265 B-270

Occurrence of the different species of Myctophidae at the different night-light stations in the Philippines

Family MYCTOPHIDÆ

Scopelini MÜLLER (1843) 321.
Scopelidæ OWEN (1846) 48 (fide Girard 1858).
Myctophidæ GILL (1893) 131.

Caudal fin well developed, free from anal. Pectorals lateral. Pelvics 6 to 11 rayed, located well behind pectorals. Palatine normal, its anterior end attached to vomer, with a process directed upward and outward, overlapping proximal end of maxillary and supported by a lateral projection of the mesethmoid. Ethmoid with a median keel. Parasphenoid extending upward to frontals between lateral ethmoids. Interopercle not reduced. Cleithrum attached to lower end of supracleithrum.

Artificial key to the genera of Myctophidæ known from the Philippines

1. Two Pol; two Prc, the second markedly elevated, close to lateral line; four VO, the second not elevated; pectoral base high, its upper end about equidistant from dorsal and ventral margins .... 3. *Hygophum.*

   One Pol; two Prc, the second not elevated, on the same level with the first, closer to ventral body margin than to lateral line 2

2. Mouth inferior, snout protruding and piglike; gill rakers reduced to short knobs; lateral line obsolescent; caudal peduncle conspicuously narrow, its least depth much less than diameter of eye. 1. *Centrobranchus.*

   Mouth terminal, snout neither protruding nor piglike; gill rakers normal; straplike or fingerlike; lateral line distinct, complete; caudal peduncle heavy, not narrow, its least depth much greater than diameter of eye 3

3. Four Prc; five VO, the first three progressively elevated forming an ascending straight line; pectoral base markedly low, much closer to ventral than to dorsal body margin ..... 4. *Diaphus.*

   Two Prc; four VO, level; pectoral base not markedly low 4

4. No luminous glands other than the definite photophores and the subdivided supracaudal and infracaudal glands of mature males and females respectively. ..... 2. *Myctophum.*

1. Genus CENTROBRANCHUS Fowler

Centrobranchus FOWLER (1904) 754 [genotype *Centrobranchus choerocephalus* FOWLER = *Scopelus nigroocellatus* GÜNTHER (1873) 267].

Teeth of jaws cardiform, in a very narrow band on premaxillaries and dentaries; a large patch on each side of head of vomer and an oblong patch on each entopterygoid; palatine teeth in single series. Maxillary slender, not expanded posteriorly, extending well beyond orbit. Lower jaw included; snout projecting. No pterotic spine. Gill rakers few, wide-set reduced to very short blunt knobs, armed with minute spines. Base of anal fin longer than that of dorsal; accessory caudal

rays soft, flexible. Lateral line obsolescent. Caudal peduncle conspicuously narrow, its least depth much less than diameter of eye.

Dn and Vn present. PLO at upper end of pectoral base. PVO forming a straight line with first PO. PO and VO level. AO in two distinct series, level. Pol well in advance of adipose fin. Two Prc level. Adult male with series of separate median luminous glands behind adipose fin; female with similar series infracaudally.

Closely related to *Gonichthys*, differing primarily in dentition, reduced gill rakers, and obsolescence of lateral line.

Artificial key to the known species of Centrobranchus

1. SAO_1 over or slightly behind VO_4; length of snout equal to or less than diameter of orbit ..... 1. *C. andreæ*
2. SAO_1 over or slightly in advance VO_3; length of snout greater than diameter of orbit ..... 2. *C. nigroocellatus*

1. CENTROBRANCHUS ANDREÆ (Lütken).

Scopelus (*Rhinoscopelus*) *andreæ* LÜTKEN (1891) 209 (Jakobshavn, Greenland); (1892) 245, *fig. 3*.
Rhinoscopelus andreæ GOODE and BEAN (1895) 90.
Myctophum coccoi andreæ BRAUER (1904) 390.
Centrobranchus gracilicaudus GILBERT (1905) 595, *pl. 69, fig. 2* ("Albatross" station *4145*, west of Niihau, Hawaii).
Myctophum (*Myctophum*) *andreæ* BRAUER (1906) 203, *fig. 122*.
Centrobranchus andreæ GILBERT (1911) 16; FRASER-BRUNNER (1949) 1062, *fig.*
Centrobranchus andræ FOWLER (1928) 67.
Myctophum nigro-ocellatum PARR (1928) 62, (in part).
Myctophum andreæ PARR (1929) 8.

Body moderately deep anteriorly, narrowing rather abruptly in the region of the adipose fin; caudal peduncle conspicuously slender. Snout pointed, protruding prominently, making the mouth strongly inferior. Upper anterior profile of head gently

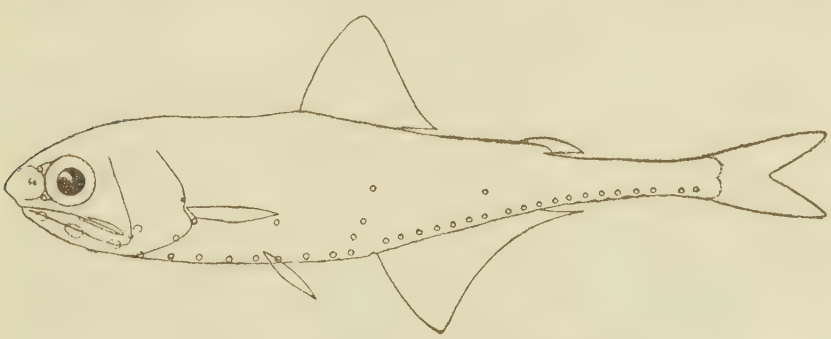


FIG. 2. *Centrobranchus andreæ* (Lütken).

rounded. Maxillary slender, not expanded posteriorly; extending well beyond orbit, about 0.4 of its length lying behind a perpendicular to mouth drawn through the posterior margin of orbit. Eye moderate in size, orbital diameter 4.2 (3.6 to 5.8) in head. No pterotic spine. Opercular margin slightly pointed, notched opposite pelvic base. This opercular notch may be absent or hardly discernible in some individuals, the opercular margin appearing evenly curved above the bluntly pointed tip. Cardiform teeth in very narrow bands on premaxillares and dentaries. Gill rakers few, wide-set, and reduced to very short blunt knobs, armed with minute spines.

Fin formula.—D. 11(11 to 12); A. 18(18 to 19); P. 12(11 to 12); V. 8. Dorsal origin markedly behind pelvic base and midway between a perpendicular from the center of the orbit and the adipose base; dorsal base 2.1(1.9 to 2.3) in anal base. Origin of adipose fin slightly in advance of end of anal base. Pectoral base about midway between hind margin of orbit and ventral base; fin extending to VLO. Ventral base on a vertical about 2.5 times as far from pectoral base as from dorsal origin, fin extending to or beyond VO_3. Scales cycloid, lateral line obsolescent.

Measurements in per mille of standard length based on 10 specimens 20.0 to 48.5 mm (average 36.6 mm) in standard length from 10 widely separated stations: length of head 264 (256 to 275); length of maxillary 158(150 to 162); diameter of orbit 63(50 to 73); distance from dorsal to ventral 211(196 to 242); distance from dorsal to anal 220(214 to 233); depth of caudal peduncle 57(46 to 63); distance from snout to dorsal 444(433 to 450); length of dorsal base 115(106 to 130); distance from snout to adipose 740(711 to 757); distance from snout to anal 530(507 to 550); length of anal base 242 (217 to 265); distance from snout to pectoral 266(249 to 295); distance from snout to ventral 373(356 to 395).

Dn and Vn present. Op_1 small, often barely visible, opposite lower posterior angle of maxillary; Op_2 distinctly larger than any of the neighboring organs, separated from Op_1 by a distance less than its own diameter. PLO very slightly above upper end of pectoral base. PVO_1 over or slightly behind PO_2, on a line connecting Op_2 and PO_5. Five PO; PO_1 slightly behind OP_2, these organs touching same vertical; first three interspaces subequal or the second slightly the largest, making the third interspace about equal to the fourth, which is

usually slightly smaller than any of the others; from ventral view these organs form two nearly straight lines that diverge posteriorly. VLO directly above first VO, on a line connecting OP_2 and SAO_2. Four VO about evenly spaced, or with the first interspace very slightly larger than the last two; first VO very slightly displaced mesad, lying immediately behind base of inner ventral rays. SAO weakly angulated with the opening directed anteriorly; SAO_1 over or slightly behind VO_4; SAO_2 about over anus clearly closer to SAO_1 than to SAO_3; SAO_3 directly over or slightly in advance of anal origin, about equidistant from dorsal and ventral body margins. Seven (5 to 8) + 10(8 to 13) AO about evenly spaced, the second AOa interspace occasionally the largest. AOp_1 well in advance of posterior end of anal base, separated from the last AOa by an interspace equal to about 0.6 depth of caudal peduncle. A single Pol directly over last AOa, well in front of adipose fin

TABLE 1. *Showing the variation in number of AO photophores in Centrobranchus andreæ based on 80 specimens (both sides counted).*

AOp \ *AOa*	5	6	7	8
8	0	0	2	0
9	0	1	13	2
10	0	21	56	6
11	1	36	17	1
12	0	3	0	0
13	1	0	0	0

and about on the same level as SAO_3. Two Prc on the same level or Prc_2 very slightly elevated; Prc_1 near ventral body margin, separated from last AOp by a space about equal to or slightly larger than that between last AOa and first AOp. In males there is a line of 6(5 to 7) embedded or deeply set supracaudal luminous glands extending from the adipose fin to a point over the AOp-Prc interspace, or in exceptional cases only to the last AOp interspace. Similarly, in females, 5(4 to 6) infracaudal glands extend within the region of the last six AOp, or extend beyond the last AOp when the number of glands is over five. Among 80 specimens examined, the youngest male found with caudal glands is 25.9 mm in standard length and the youngest female 34.5 mm. Whether the sexes mature in the respective sizes stated above is not conclusive due to the small number of fish captured.

TABLE 2. *Showing the catch of Centrobranchus andreæ in the different ranges of temperatures at 21 widely separated stations.*

Temperature °C	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Degree centigrade			*Per cent*		
30.1 to 30.5	2	0	0	0	0
29.6 to 30.0	7	1	14	3	0.4
29.1 to 29.5	17	6	35	41	2.4
28.6 to 29.0	29	5	17	9	0.3
28.1 to 28.5	4	2	50	2	0.5
27.6 to 28.0	4	0	0	0	0
27.1 to 27.5	2	1	50	3	1.5
26.6 to 27.0	4	3	75	13	3.3
26.1 to 26.5	5	3	60	8	1.6
Less than 26.0	1	0	0	0	0

Not a single specimen was captured at stations that registered 26° C or above 30° C, but since only three stations were occupied in these temperature ranges no definite statement can be made as to the limits of temperature tolerance. There appears to be no correlation between the temperature and the percentage of positive stations or the average number of specimens captured per station and no conclusions as to temperature preference can be reached.

TABLE 3. *Presenting evidence with regard to salinity.*

Salinity	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Parts per mille			*Per cent*		
34.21 to 34.60	18	2	11	3	0.2
33.81 to 34.20	36	7	19	18	0.5
33.41 to 33.80	14	8	57	21	1.5
33.01 to 33.40	6	4	67	37	6.2
32.61 to 33.00	1	0	0	0	0

The lower limit of salinity tolerance could not be determined with any precision due to lack of sufficient data; the single station (32.63 parts per mille) included in the 32.61 to 33.00 parts per mille salinity range was negative. However, within the next higher salinity range (33.01 to 33.40 parts per mille) 67 per cent of the six stations were positive and the average catch was 6.2 fish per station. Values for both positive stations and fish per station were higher than in any other salinity range occupied. As the salinity rises above 33.40 parts per mille, the percentage of stations positive and the number of fish captured per station gradually decreases. These results apparently show that this particular species has a preference for an environment with lower salinity which further explains the fact that they are taken much more commonly in the less saline

China Sea (80 per cent of all stations occupied) and Sulu Sea (30.6 per cent of all stations occupied) than in the more saline Celebes Sea (8.6 per cent of all stations occupied).

It may be stated that *Centrobranchus andreæ* may be found in truly marine waters which have a surface temperature ranging from 26.3° C to 29.6° C and a salinity of 33.06 to 34.29 per mille.

2. **CENTROBRANCHUS NIGROOCELLATUS (Günther).**

Scopelus nigroocellatus GÜNTHER (1873) 267 (South Atlantic Ocean).
Scopelus nigro-ocellatus GÜNTHER (1889) 30.
Centrobranchus choerocephalus FOWLER (1904) 754 (Near Hawaiian Islands); GILBERT (1905) 594, *pl. 69, fig. 1.*
Myctophum (Myctophum) coccoi f. *regularis* BRAUER (1904) 390.
Myctophum (Myctophum) choerocephalus BRAUER (1906) 202, *fig. 121.*
Myctophum nigro-ocellatum PARR (1928) 62 (in part).
Centrobranchus nigro-ocellatus FRASER-BRUNNER (1949) 1062. *fig.*

Body rather slender, tapering gently from dorsal origin and narrowing abruptly in the region of the adipose fin, caudal peduncle markedly slender. Snout pointed and protruding,

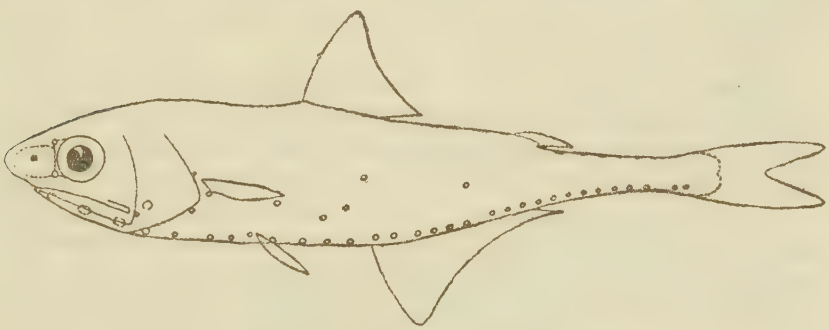


FIG. 3. *Centrobranchus nigroocellatus* (Günther).

measured to tip about equal to or greater than diameter of orbit. Mouth strongly inferior. Upper anterior profile gently rounded to region of nape. Eye moderate in size, orbital diameter about 4 (3.7 to 4.2) in head. Maxillary not at all expanded posteriorly, extending well beyond eye, about 0.4 of its length lying behind a perpendicular to mouth drawn through posterior margin of orbit. No pterotic spine. Cardiform teeth in very narow bands on premaxillaries and dentaries; a large patch of teeth on each side of head of vomer and an oblong patch on each entopterygoid; palatine teeth in single series. Opercular margin pointed. Gill rakers few, wide-set, atrophied to very short blunt knobs armed with minute spines.

Fin formula.—D. 11(10 to 11); A. 19(18 to 19); P. 12(11 to 12); V. 8. Dorsal origin well behind pelvic base, midway between a perpendicular from the center of orbit and adipose base; dorsal base 2.4(2.3 to 3.5) in anal base. Origin of adipose fin slightly in advance of last anal fin ray. Pectoral base well in advance of dorsal and on a vertical about midway between tip of lower jaw and anal origin; fin extending beyond VLO or first VO. Ventral base on a vertical about 1.5 times as far from pectoral base as from dorsal origin; fin extending to or beyond VO_3. Scales cycloid, lateral line obsolescent.

Measurements in per mille of standard length based on six specimens 27.0 to 36.2 mm (average 31.35 mm) in standard length from five stations: length of head 271(260 to 280); length of maxillary 157(153 to 162); diameter of orbit 69(63 to 74); distance from dorsal to ventral 200(183 to 226); distance from dorsal to anal 202(195 to 212); depth of caudal peduncle 46(44 to 47); distance from snout to dorsal 459(438 to 470); length of dorsal base 103(98 to 110); distance from snout to adipose 730(724 to 740); distance from snout to anal 537(525 to 544); length of anal base 247(235 to 260); distance from snout to pectoral 272(262 to 287); distance from snout to ventral 366(355 to 382).

Dn and Vn present. Op_1 rather small, embedded in a bespeckled portion of the cheek opposite posterior angle of maxillary; Op_2 markedly larger than any of the neighboring organs directly above first PO and separated from Op_1 by a distance less than its own diameter. PLO reduced to about half the size of neighboring organs, directly above PVO_1 and very slightly above level of upper end of pectoral base. PVO_1 far behind PO_2, on a line connecting PO_2 and PVO_2 and clearly closer to the latter organ. Five PO; PO_1 directly below Op_2, equidistant from and forming a right angle with Op_2 and PO_2; third and fourth interspaces subequal, about an organ diameter smaller than the first and two organ diameters smaller than the second; from ventral view these organs form two nearly straight lines that diverge posteriorly. VLO well behind pectoral base, directly over first VO and about twice as close to ventral as to dorsal body margin. Four VO about evenly spaced and forming two straight parallel lines when viewed ventrally; VO_1 just posteromesad to base of inner ventral rays. SAO forming a nearly straight line or a very obtuse angle with the opening directed forward; SAO_1 about on the same level as Op_2, slightly in advance of VO_3 and on a line connecting

VO_2 and SAO_3; SAO_2 on the same level as VLO, about over or slightly in advance of last VO, on a line connecting VO_3 and SAO_3; SAO_3 directly below or slightly in advance of posterior end of dorsal base. Six (5 to 7) + 10(9 to 11) AO about evenly spaced, the second AOa interspace occasionally somewhat larger than the others. First AOp well in advance of posterior end of anal base, separated from last AOa by an interspace equal to about 0.5 depth of caudal peduncle. A single Pol on the same level as SAO_3, directly above last AOa or on a vertical twice as close to adipose base as to anal origin. Two Prc, Prc_2 not noticeably elevated. Prc_1 near ventral body margin, separated from last AOp by a space somewhat equal to or slightly larger than that between last AOa and first AOp. My smallest specimen, 15.7 mm in standard length, has no signs of caudal glands at all. Five male individuals 27.0 to 36.2 mm in standard lengths have 6(6 to 7) deeply set supracaudal glands with darkly pigmented margins. These glands extend from somewhat behind adipose base or directly above fifth AOp to a vertical about an organ diameter before Prc_1. In a single female specimen 34.0 mm in standard length, four similar glands occur infracaudally, extending from directly above AOp_8 to slightly beyond last AOp.

Centrobranchus nigroocellatus is a rather rare species in Philippine waters. Only two fish were captured at station B–522 in the China Sea west of Palawan and five others, one individual from each station, at B–128, 131, 139, 400, and 522, all from the Celebes Sea.

The scarcity of this species is probably due to its preference for cooler waters; specimens were captured only at stations that registered temperatures ranging from 26.92 to 28.86° C. However, it was captured at salinities ranging from 33.21 to 34.40 parts per mille, which indicates tolerance to fairly wide fluctuations in regard to this factor.

2. Genus MYCTOPHUM Rafinesque

Myctophum Rafinesque (1810) 56 (genotype by monotypy *Myctophum punctatum* Rafinesque).

Scopelus Cuvier (1817) 169 [genotype by subsequent designation of Jordan (1917), *Gasteropelecus humbolti* Risso].

Dasyscopelus Günther (1864) 405 (as a subgenus; genotype by subsequent designation of Goode and Bean (1895), *Myctophum asperum* Richardson).

Teeth of jaws cardiform. Gill rakers well developed. Dorsal base much shorter than anal base. Lateral line present, com-

plete. Vn and Dn present, the latter sometimes wanting. No photophores above lateral line; five PO, the fourth never elevated; PLO definitely above pectoral base; four VO level; AO in two separate series; one Pol; two Prc. No luminous glands other than the definite photophores and the subdivided supracaudal and infracaudal glands of mature males and females respectively.

Artificial key to the known species of Myctophum

1. SAO strongly angulated, SAO_1 and SAO_2 more nearly in line with VLO than with SAO_3; SAO_1 directly over or slightly behind VO_3. ..... 7. *M. evermanni*

   SAO not strongly angulated, forming a very obtuse angle; SAO_1 usually anterior to, rarely directly over VO_4 ..... 2.

   SAO strictly in a straight line; SAO_1 directly over or slightly behind VO_4 ..... 4.

2. SAO_1 over or slightly behind VO_3; adipose base over or slightly behind posterior end of anal base; each of the scales over AO photophores with a markedly enlarged spines, these forming a clear linear series in specimens more than 25 mm in standard length ..... 5. *M. spinosum*

   SAO_1 over or slightly in advance VO_4; adipose base clearly in advance posterior end of anal base; scales over AO photophores without an enlarged series of spines ..... 3.

3. Upper posterior end of opercular margin never denticulate, its distance from hind border of orbit about equal to or less than diameter of eye ..... 4. *M. pristilepis*

   Upper posterior end of opercular margin denticulate in specimens more than 30 mm in standard length, its distance from hind border of orbit greater than diameter of eye ..... 3. *M. brachygnathos*

4. Dn absent; anal rays 23 to 25; gill rakers 4 to 5 + 1 + 11 to 13 (total 16 to 19) ..... 1. *M. aurolaternatum*

   Dn present; anal rays 19 to 21; gill rakers 6 to 7 + 1 + 14 to 16 (total 21 to 24); AO 6 to 10 + 12 to 16 (total 12 to 16) ..... 5.

5. Op_2 separated from Op_1 by a space equal to or less than its own diameter; pectoral extending about to vertical of VO_2; scales cycloid at all ages ..... 2. *M. margaritatum*

   Op_2 separated from Op_1 by a space greater than its own diameter; pectoral extending to or beyond vertical of VO_4 scales strongly ctenoid, with a row of enlarged spines on those covering the AO photophores, clearly visible in mature specimens..... 6. *M. lychnobium*

1. **MYCTOPHUM AUROLATERNATUM** Garman.

Myctophum aurolaternatum Garman (1899) 264, *pl. 55, fig. 3* ("Albatross" station 3382, off Pacific coast of Panama); Parr (1928) 65; Beebe and Vander Pyl (1944) 64.

Myctophum (*Myctophum*) *aurolaternatum* Brauer (1904) 389; Brauer (1906) 162; Bolin (1939) 108, *fig. 10;* Fraser-Brunner (1949) 1057, *fig.*

Myctophum aurolaternatum gracilior FOWLER (1944) 355, *fig. 88*, 368, 372, 490 (250 miles southwest of Acapulco, Mexico).
Myctophum aurolaternatum aurolaternatum FOWLER (1944) 490.

Body slender, very slightly compressed and tapering rather evenly from nape to moderately slender caudal peduncle. Upper

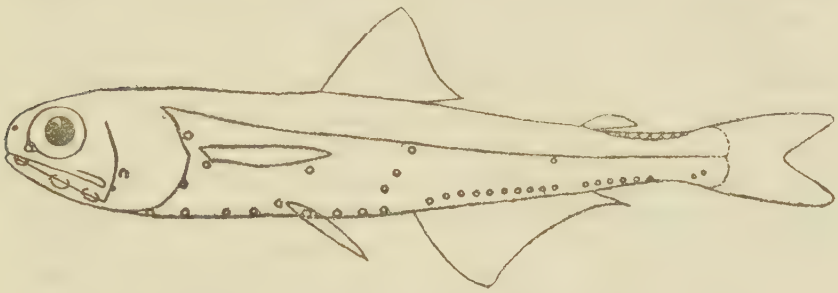


FIG. 4. *Myctophum aurolaternatum* Garman.

anterior profile of head gently rounded, mouth terminal. Maxillary very slightly and evenly expanded posteriorly, its posterior margin evenly rounded, extending well beyond orbit, about 0.3 of its length lying behind a perpendicular to mouth drawn through posterior margin of orbit. Eye moderate in size, orbital diameter about 1.5 times length of snout or almost three times in head. The head of this species becomes proportionately larger with advancing age and this differential growth also affects its parts, such as the orbit and the maxillary. Opercular margin ending in a short blunt point; its upper margin at the region of the lateral line becoming dentate in specimens about 30 mm in standard length, the spination readily visible to the naked eye in adults. Gill rakers comparatively short and heavy, their internal edges with coarser denticles than in most species belonging to the same genus. The number is 5(4 to 5) + 1 + 12(11 to 13) on the first arch (25 specimens counted).

Fin formula.—D. 14(14 to 15); A. 24(23 to 25); P. 14(13 to 14); V. 8. Dorsal origin slightly behind origin of ventral fin and midway between snout and a point somewhere between third and last AOp; dorsal base 1.7(1.5 to 1.9) in anal base. Adipose fin slightly in advance of posterior end of anal base. Pectoral base about midway between snout and anal origin; fin extending to VO_1 or VO_2. Ventral base about two or three times as far from pectoral base as from dorsal origin; fin

extending almost or quite to VO_4. Scales cycloid, 44 to 45 in lateral line.

Measurements in per mille of standard length based on ten specimens 29.0 to 89.0 mm (average 64.2 mm) in standard length: length of head 280(265 to 297); diameter of orbit 100(92 to 111); length of maxillary 169(161 to 181); distance from dorsal to ventral 167(145 to 184); distance from dorsal to anal 219(197 to 237); distance from snout to dorsal 440(421 to 463); depth of caudal peduncle 68(65 to 73); length of dorsal base 147(134 to 163); distance from snout to anal 588(552 to 616); length of anal base 257(243 to 283); distance from snout to adipose 837(816 to 852); distance from snout to pectoral 288(271 to 310); distance from snout to ventral 407(378 to 426).

A small Vn. Op_1 almost as large as general body photophores but deeply embedded, often indistinct, opposite lower posterior angle of maxillary; Op_2 a little larger than neighboring organs, slightly above level of PVO_1, separated from OP_1 by a distance about equal to its own diameter. PLO slightly behind PVO_1 midway between lateral line and upper end of pectoral base or slightly lower. PVO_1 directly over or slightly in advance of PO_2, about on a line connecting PO_1 and PVO_2 which is at base of lower pectoral rays, well in advance of PO_3. Five PO; PO_1 well behind Op_2, these organs not touching same vertical; first two interspaces subequal or the second slightly the larger, often almost twice as great as third which is equal to or slightly smaller than fourth; from ventral view the middle three organs form parallel lines, the first organs displaced slightly toward the midline, the last abruptly divergent and located just in advance of and very slightly mesad to base of outer ventral rays. VLO about over or slightly in advance of VO_1, midway between ventral base and lateral line or slightly higher. Four VO; the first interspace somewhat larger than the posterior two; VO_1 just posteromesad to inner ventral rays, last three organs very slightly displaced laterally, forming straight lines. SAO forming an oblique straight line which passes through or slightly anterior to VO_4; SAO_2 noticeably closer to SAO_1 than to SAO_3; SAO_1 directly over or slightly behind VO_4; SAO_2 about over anus; SAO_3 directly over or slightly in advance of anal origin. Ten(9 to 11) + 6(5 to 7) AO about evenly spaced; first one or two AOa noticeably depressed; AOp_1 about over or slightly anterior to base of last anal ray, separated

TABLE 4. *Showing the variation in number of AO photophores in Myctophum aurolaternatum based on 145 specimens (both sides counted).*

AOp \ AOa	9	10	11	12
5	1	18	23	2
6	21	123	61	3
7	8	20	8	1
8	1	0	0	0

from last AOa by a space equal to from 0.5 to 0.7 depth of caudal peduncle. A single Pol directly over or somewhat behind last AOa, almost in contact with lateral line. Prc_1 near ventral body margin, separated from last AOp by a space 1.1 to 1.8 times as wide as that between last AOa and first AOp; Prc_2 slightly elevated but much nearer base of lower caudal rays than lateral line. A line of 9 (3 to 10) supracaudal luminous glands, each one outlined in black, extending from adipose fin to or almost to Prc_1 in males. Similar small glands occur lateral to the anterior ones of the main series. In females, 2 to 6 infracaudal glands extend from the fourth or fifth AOp to the base of the lowest or most anterior procurrent caudal ray. These glands are much smaller than those of the males and lie in a strictly median series. The caudal glands are developed only in males over 30 mm and females over 40 mm in standard length, but not all specimens of this size bear these glands. Occasionally a specimen as much as 57.3 mm in standard length will show no trace of caudal glands whatsoever. Although the range in the number of caudal glands is wide, there is no indication that their number increases with age.

The availability of a considerable amount of material from several localities at which some hydrographic data have been recorded permits, for the first time, a moderately accurate assessment of some of the ecological requirements of this species. Table 5 shows that the catch at temperatures above 28.5° C was more than two fish per station occupied (average 2.5), while from 26.5° to 28.5° C the catch was less than 0.5 fish per station (average 0.2). No specimens at all were taken at the six stations where the temperature went below 26.5° C. The maximum temperature which the organism may endure, or even the upper limit of the optimum range, is unknown

TABLE 5.—*Showing the catch of Myctophum aurolaternatum at different ranges of temperature.*

Temperature	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Degrees centigrade			*Per cent*		
30.1 to 30.5	2	2	100	5	2.5
29.6 to 30.0	7	2	29	16	2.3
29.1 to 29.5	17	11	65	42	2.5
28.6 to 29.0	29	11	38	77	2.6
28.1 to 28.5	4	1	25	2	0.5
27.6 to 28.0	4	1	25	1	0.2
27.1 to 27.5	2	0	0	0	0
26.6 to 27.0	4	1	25	1	0.2
26.1 to 26.5	5	0	0	0	0
Less than 26.0	1	0	0	0	0

since there is no clear reduction either in the percentage of positive stations or in the catch per station toward the upper limit of temperature recorded.

TABLE 6.—*Showing the catch of Myctophum aurolaternatum at different ranges of salinity.*

Salinity	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Parts per mille			*Per cent*		
34.21 to 34.60	18	4	22	5	0.3
33.81 to 34.20	36	16	44	69	1.9
33.41 to 33.80	14	5	36	40	2.9
33.01 to 33.40	6	3	50	29	4.8
32.61 to 33.00	1	1	100	1	1.0

Table 6 presents similar evidence in regard to salinity. While the lower limit of salinity tolerance remains a mystery, the percentage of postive stations and the catch per station shows a clear decline with increased salinity between the ranges of 33.00 and 34.60 parts per mille, the catch becoming very low at the highest values. It may thus be stated that *Myctophum aurolaternatum* may be expected to occur in truly marine waters with a surface temperature of more than 28° C and a salinity of less than 34.20 parts per mille.

The species is particularly common in the Sulu Sea where it was taken at 56 per cent of all the stations occupied. It is much less common in the Celebes Sea where it was found at only 22 per cent of the stations. A single specimen was captured at Station B–490 on the west coast of Mindoro, and one at Station G–83 in the Pacific off the southern end of Luzon. The number of stations in the latter areas were insufficient to give any clear idea as to how common it is in these waters.

This species has previously been known only from the west coast of Central America. It is surprising that, although abundant in the Philippine area, it has not been reported from this region before now. The striking similarity between the members of the two known populations indicates strongly that they belong to one species with a continuous distribution. They are so much alike that it seems inadvisable to attempt even a subspecific differentiation at present. It is strongly urged that future collectors make every effort to secure specimens from the area between America and the Philippines, in order to arrive at a more definite conclusion as to whether the two populations are actually spatially separated or whether they form two sections of a much more extensive continuous population.

2. MYCTOPHUM MARGARITATUM Gilbert.

Myctophum margaritatum GILBERT (1905) 596, *pl. 68, fig. 2* ("Albatross" station 3930, off the south coast of Molokai, Hawaii).

Body moderately robust throughout, tapering from nape or origin of first dorsal fin to a quite slender caudal peduncle. Upper anterior profile of head gently rounded; snout steep,

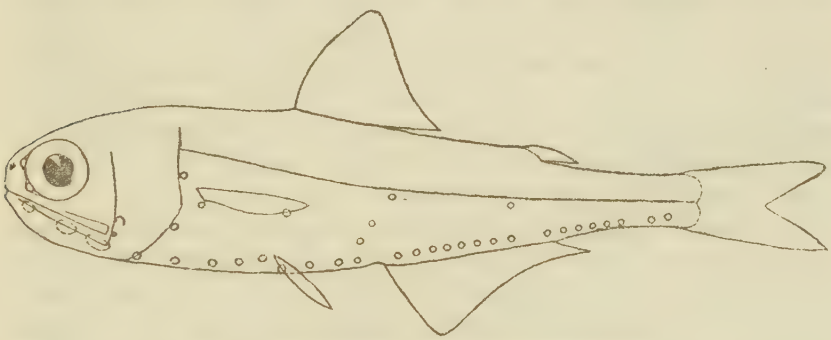


FIG. 5. *Myctophum margaritatum* Gilbert.

bluntly rounded; mouth terminal. Maxillary slightly and evenly expanded posteriorly, its posterior margin bluntly rounded, extending well beyond orbit, about 0.4 of its length lying behind a perpendicular to mouth drawn through posterior margin of orbit. Eye moderate in size, orbital diameter about 2.8 times in head. Opercular margin ending in an obtuse, rather angular, blunt point above level of PVO_1; upper margin rising almost vertically from this point, a short portion of its dorsal edge denticulate, the spination beginning to be fairly discernible in

specimens of about 40 mm in standard length. Gill rakers moderately long and slender, 6(6 to 7) + 1 + 15(14 to 16) on first arch.

Fin formula.—D. 13; A; 20(19 to 20); P. about 13(13 to 14), the lower rays extremely delicate and difficult to count; V. 8. Dorsal origin nearly directly above pelvic base on a perpendicular midway between center of orbit and adipose base; dorsal base 1.8(1.7 to 2.0) in anal base. Anal origin directly below or very slightly behind base of last dorsal ray. Pectoral base equidistant between dorsal and ventral body margins, about midway between verticals from hind border of preopercle and pelvic base; fin extending clearly beyond VLO. Ventral base midway between PO_2 and anus; fin extending beyond VO_3, sometimes to VO_4. Scales cycloid, 39 (38 to 40) in lateral line.

Measurements in per mille of standard length based on ten specimens 28.7 to 65.0 mm (average 52.6 mm) in standard length from ten widely distributed stations: length of head 275(263 to 282); length of maxillary 178(166 to 188); diameter of orbit 99(97 to 104); distance from dorsal to ventral 219(204 to 238); distance from dorsal to anal 256(241 to 269); depth of caudal peduncle 85(80 to 92); distance from snout to dorsal 444(433 to 459); length of dorsal base 144(129 to 155); distance from snout to adipose 768(755 to 787); distance from snout to anal 571(557 to 595); length of anal base 264(246 to 277); distance from snout to pectoral 286(271 to 303); distance from snout to ventral 403(392 to 411).

Dn and Vn present, the latter often hardly visible when covered by the whitish tissue enveloping the nasal sac. Op_1 small usually barely discernible, opposite lower posterior angle of maxillary; Op_2 slightly larger than any of the body organs, separated from Op_1 by a distance about equal to its own diameter. PLO slightly above upper end of pectoral base, markedly nearer to it than to lateral line. PVO_1 directly above PO_2 about on the same level as Op_2, on a line connecting first PO and PVO_2, which is immediately below and in contact with base of lower pectoral rays. Five PO; PO_1 well behind Op_2, these organs nearly touching same vertical; first two interspaces subequal, either one often slightly larger than the other; third and fourth interspaces usually subequal, markedly smaller than either one of the first two interspaces, the third occasionally smaller than the fourth; from ventral view these organs form nearly straight lines that diverge posteriorly.

SAO forming a straight but rather steep series of organs in a line passing through the third VO interspace, or nearly forming a straight line with VO_3; SAO_1 directly above VO_4 about on the same level as Op_2 and PVO_1; SAO_2 about over anus, usually equidistant between SAO_1 and SAO_3, not infrequently slightly closer to the former than to the latter; SAO_3 directly above anal origin, nearly touching lateral line and equidistant from dorsal and ventral body margins. Nine (6 to 10) + 5(3 to 6) AO about evenly spaced; first AOa

TABLE 7.—*Showing the variation in number of AO photophores in Myctophum margaritatum based on 495 specimens (both sides counted).*

AOp \ *AOa*	6	7	8	9	10
3	0	0	0	1	0
4	0	0	10	75	2
5	0	3	217	477	20
6	1	2	102	79	4

slightly behind anal origin (about over base of fifth anal ray); AOp_1 immediately above posterior end of anal base, separated from last AOa by a space equal to about 0.5 depth of caudal peduncle. A single Pol directly above last AOa, less than its own diameter from lateral line. Prc_1 near ventral body margin, separated from last AOp by a space as wide as, or often less than that between last AOa and first AOp; Prc_2 slightly elevated but markedly nearer base of lower caudal rays than lateral line. In males a line of 7(2 to 9) supracaudal luminous glands each with a thin marginal band of black pigment; these usually extend from somewhere under adipose fin to the vertical of Prc_1, very seldom if ever, slightly beyond, but in small specimens with few glands may originate as far posterior as the vertical of the last AOp. Mature females have 3(1 to 6) similar structures infracaudally, but these are smaller and their margins are much less heavily pigmented. These glands extend from somewhere between the third and last AOp to about an organ diameter in front of Prc_1. The smallest male with at least a faint trace of caudal glands is 30.4 mm in standard length, and the smallest female is 36.0 millimeters. The largest individual without any trace of even a single caudal gland is a specimen 41.7 mm in standard length. There appears to be a slight tendency for the caudal glands to increase in number with advancing age in the sexes. Males smaller than 35 mm in standard length usually have 5 supracaudal glands, from this

size to a length of about 42 mm 6 is the most common number, from about 42 to 54 mm the average number is 7, while above that size 8 becomes equally common. In females the average number of infracaudal glands changes from 2 in specimens below 44 mm in standard length to 3 in individuals 44 to 55 mm long, while the largest specimens tend to have 4 glands. It is rather interesting that four of the large females investigated have both supra- and infra-caudal glands. In all of these cases, the number of infra-caudal glands is 4, while the number of supra-caudal glands varies from 2 to 6.

This is the second most common species of myctophid found in Philippine waters. Table 8 shows the average catch of *Myctophum margaritatum* at different ranges of temperature. As the temperature rises, there is a marked increase in the number of fish captured per station. Above 28.5°C, the average catch per station was 8.1 fish as compared with only 2.1 fish per station at lower temperatures. However, neither the upper nor lower temperature limit that this species may endure is known, since specimens were taken at both the warmest and coldest stations occupied.

TABLE 8.—*Showing the average catch of Myctophum margaritatum at different ranges of temperature.*

Temperature	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Degrees centigrade			*Per cent*		
30.1 to 30.5	2	2	100	48	24.0
29.6 to 30.0	7	5	71	43	6.9
29.1 to 29.5	17	15	88	125	7.4
28.6 to 29.0	29	20	69	224	7.7
28.1 to 28.5	4	3	75	9	2.2
27.6 to 28.0	4	2	50	12	3.0
27.1 to 27.5	2	2	100	9	4.5
26.6 to 27.0	4	1	25	5	1.3
26.1 to 26.5	5	2	40	6	1.2
Less than 26.0	1	1	100	1	1.0

With regard to salinity, Table 9 shows a rather even distribution of percentage of positive stations at the various

TABLE 9.—*Showing the catch of Myctophum margaritatum at different ranges of salinity.*

Salinity	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Parts per mille			*Per cent*		
34.21 to 34.60	18	12	67	45	2.5
33.81 to 34.20	36	28	78	227	6.3
33.41 to 33.80	14	8	57	49	3.5
33.01 to 33.40	6	4	67	165	27.5
32.61 to 33.00	1	1	100	1	1.0

salinities. This species probably prefers a salinity between 33.01 and 34.20 parts per mille, as indicated by an average catch of 7.9 fish per station. This average is comparatively much higher than that of either the highest or the lowest salinity range recorded which is 2.5 and 1.0 respectively. Again nothing definite can be said in regard to the maximum or minimum salinities this organism may withstand, due to insufficient data.

This species is quite abundant in the Sulu Sea which possibly offers it optimum conditions. It was taken at 86 per cent of all stations occupied, and the catch averaged 11.1 fish per station. The Celebes Sea registered 60 per cent positive stations, and showed an average catch of 2.2 fish per station. All of the four stations in the Pacific Ocean were positive and averaged 2.3 fish per station. The China Sea registered no catch at all, which is probably due to the smaller number (4) of stations occupied, since both the temperature and salinity is within the range that this particular species can endure.

3. **MYCTOPHUM BRACHYGNATHOS** (Bleeker).

Scopelus brachygnathos BLEEKER (1856) 65 (Menado, on the northeastern tip of Celebes).

Myctophum brachygnathos BLEEKER (1875) 152, *pl. 277, fig. 3.*

Myctophum (*Myctophum*) *brachygnathos* FRASER-BRUNNER (1949) 1058, *fig.*

Body robust throughout, narrowing evenly from dorsal origin to moderately slender and short caudal peduncle. Upper anterior profile gently rounded; snout descending gradually to

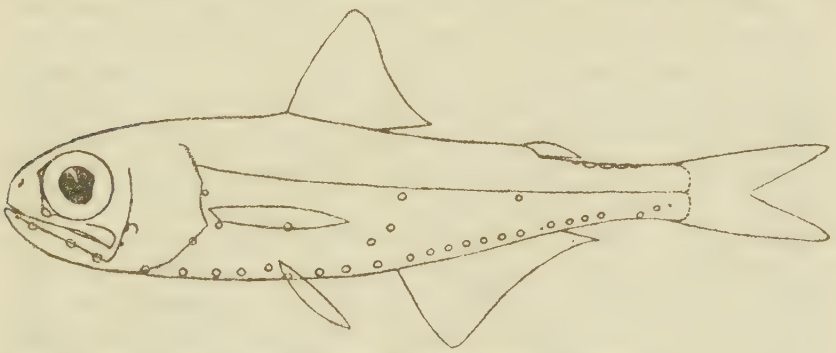


FIG. 6. *Myctophum brachygnathos* (Bleeker).

a steep and bluntly rounded point; mouth terminal, tip of lower jaw very slightly protruding. Maxillary markedly expanded posteriorly, its posteroventral margin slightly curved downward, its end bluntly rounded, extending slightly beyond hind

margin of orbit, about 0.2 of its length lying behind a perpendicular to mouth drawn through posterior margin of orbit. Eye rather large, orbital diameter 2.6(2.3 to 2.9) in head. Upper margin of opercle dentate, the spination beginning to be visible at about 30.0 mm in standard length, lower portion marked by a pointed flap on about the same level as PVO_2, almost evenly rounded ventrally. Gill rakers moderately long and heavy, those at angle equal to about 0.5 (0.5 to 0.6) diameter of orbit; 8(7 to 8) + 1 + 18(17 to 20) on first gill arch.

Fin formula.—D. 13(12 to 13); A. 18(18 to 19); P. about 18(15 to 20), the lower rays extremely delicate and often hardly discernible; V. 8. Dorsal origin directly above or very slightly behind pelvic base, on a perpendicular midway between anterior margin of orbit and adipose base; dorsal base 1.8(1.6 to 1.9) in anal base. Anal origin directly below or slightly behind posterior end of dorsal base. Pectoral base clearly closer to ventral than to dorsal body margin, equidistant between tip of snout and anal origin; fin extending well beyond VLO, to or rarely beyond VO_3. Ventral base about midway between snout and base of last anal ray; fin extending well beyond VO_3 or quite to VO_4. Scales slightly ctenoid, serration beginning to be fairly visible in individuals 35 mm in standard length.

Measurements in per mille of standard length based on ten specimens 15.0 to 79.5 mm (average 48.6 mm) in standard length from ten widely distributed stations: length of head 286(276 to 296); length of maxillary 178(171 to 192) diameter of orbit 107(99 to 116); distance from dorsal to ventral 218(207 to 233); distance from dorsal to anal 260(243 to 270); depth of caudal peduncle 80(71 to 90); distance from snout to dorsal 439(423 to 459); length of dorsal base 149(141 to 163); distance from snout to adipose 774(753 to 790); distance from snout to anal 569(540 to 594); length of anal base 274(261 to 306); distance from snout to pectoral 292(273 to 317); distance from snout to ventral 413(393 to 434).

Dn and Vn present, the latter markedly larger than the former, often hardly visible when deeply embedded in the pigmented tissue that connects these two organs. Op_1 small, quite distinct, lying opposite middle part of maxillary expansion; Op_2 markedly larger than general body organs, separated from Op_1 by a space clearly greater than its own diameter. PLO about twice as close to pectoral base as to lateral line, lying under the border of the opercle. PVO_1 about

on the level of the Op_1–Op_2 interspace, directly above or slightly behind PO_2, forming a nearly vertical line connecting it and PLO. Five PO; PO_1 slightly behind Op_2, these two organs about touching the same perpendicular; all interspaces subequal except the third which is usually the smallest or rarely the last two interspaces are subequal and slightly smaller than the first two; from ventral view the middle three organs form parallel lines, the first organs displaced slightly mesad, the last markedly divergent, located just in front of outer ventral rays. VLO about over base of inner ventral ray, nearly midway between lateral line and ventral body margin. Four VO; VO_1 very slightly displaced toward the midline, immediately mesad to base of inner ventral ray; all interspaces usually subequal, rarely the middle slightly smaller than the other two or not infrequently the first one slightly the largest; from ventral view all organs form nearly perfectly parallel lines, SAO forming a very obtuse angle, sometimes approximating a straight line; SAO_1 slightly in advance of last VO or rarely directly above it; SAO_2 markedly nearer to SAO_1 than to SAO_3 which is almost touching lateral line and well behind posterior

TABLE 10.—*Showing the variation in number of AO photophores in Myctophum brachygnathos based on 74 specimens (both sides counted).*

AOp \ *AOa*	7	8	9
3	7	6	0
4	57	50	2
5	22	3	0
6	1	0	0

end of dorsal base. Seven (7 to 9) + 4(3 to 6) AO about evenly spaced; first AO well behind anal origin; AOp_1 in advance of posterior end of anal base, separated from last AOa by an interspace equal to about 0.5 depth of caudal peduncle. A single Pol directly over last AOa and below anterior end of adipose fin, almost touching lateral line. Prc_1 near ventral body margin, separated from last AOp by a space slightly larger than or rarely equal to that between last AOa and first AOp; Prc_2 slightly elevated. A line of 5(4 to 6) supracaudal luminous glands, each one with black pigmented margins, extending from directly above second AOp to vertical of Prc_1 in males. In females 2(1 to 3) smaller and less heavily pigmented glands occur infracaudally and extend from below third AOp to about an organ diameter in front of Prc_1.

Tables 11 and 12 showing the percentage of positive stations and the average number of fish taken per station at various temperature and salinity ranges are presented. The low

TABLE 11.—*Showing the catch of Myctophum brachygnathos at different ranges of temperature.*

Temperature	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Degrees centigrade			*Per cent*		
30.1 to 30.5	2	0	0	0	0
29.6 to 30.0	7	3	43	18	2.6
29.1 to 29.5	17	2	12	4	0.2
28.6 to 29.0	29	6	21	23	0.8
28.1 to 28.5	4	1	25	1	0.3
27.6 to 28.0	4	3	75	11	2.8
27.1 to 27.5	2	0	0	0	0
26.6 to 27.0	4	0	0	0	0
26.1 to 26.5	5	1	20	2	0.4
Less than 26.0	1	1	100	1	1.0

number of stations occupied in the highest and lowest ranges of temperature and in the lowest salinity range do not provide adequate data and the results at the remaining stations are so irregular that no valid conclusions as to the ecological preferences of this species can be drawn.

TABLE 12.—*Showing the catch of Myctophum brachygnathos at different ranges of salinity.*

Salinity	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Parts per mille			*Per cent*		
34.21 to 34.60	18	5	28	14	0.8
33.81 to 34.20	36	9	25	40	1.1
33.41 to 33.80	14	1	7	1	0.1
33.01 to 33.40	6	2	33	5	0.8
32.61 to 33.00	1	0	0	0	0

4. **MYCTOPHUM PRISTILEPIS** (Gilbert and Cramer).

Dasyscopelus pristilepis GILBERT and CRAMER (1896) ("Albatross" station 286, surface tow net, 21° 15′ 49″ N., 157° 44′ 27″ W., Hawaii).

Diaphus chrysorhynchus GILBERT and CRAMER (1896) *pl. 38, fig. 2,* (Typographical error).

Myctophum (*Myctophum*) *pristilepis* BRAUER (1906) 163.

Myctophum pristilepis GILBERT (1906) 259, *pl. 3;* WEBER (1913) 88; WEBER and DE BEAUFORT (1913) 165, *fig. 64;* PARR (1928) 62.

Body moderately robust throughout, tapering evenly from dorsal origin to moderately slender and rather short caudal peduncle. Upper anterior profile gently rounded; snout steep,

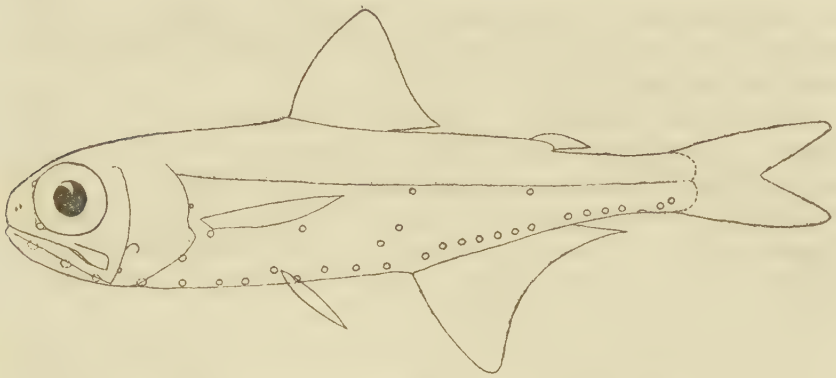


FIG. 7. *Myctophum pristilepis* (Gilbert and Cramer).

bluntly rounded; mouth terminal. Maxillary rather short, extending slightly beyond eye, about 0.2 of its length behind a perpendicular to mouth drawn through hind margin of orbit, expanded posteriorly, its posteroventral margin slightly curved downward, its end bluntly rounded. Eye large, orbital diameter 2.5 (2.3 to 2.6) in head. Opercular margin ending in a slightly pointed flap immediately above PVO_1. Gill rakers long, slender, those at angle equal to about 0.5 diameter of orbit; 8(8 to 9)+1+18(18 to 19) on first arch.

Fin formula.—D. 13(12 to 13); A. 18(18 to 19); P. about 18(16 to 18), the lower rays, extremely delicate and either destroyed or hardly visible; V. 8. Dorsal origin very slightly behind pelvic base, about equidistant between anterior margin of orbit and posterior end of adipose base. Pectoral base slightly closer to ventral than to dorsal body margin, on a vertical midway between hind margin of orbit and dorsal origin; fin extending far beyond VLO and about to the vertical of middle of dorsal base or of VO_3. Ventral base very slightly anterior to dorsal origin; fin extending to or beyond VO_3. Scales strongly ctenoid, 36+1(1 to 2) in lateral line.

Measurements in per mille of standard length based on ten specimens 38.1 to 64.7 mm (average 55.2 mm) in standard length from six available stations: length of head 278(265 to 288; length of maxillary 166(158;173); diameter of orbit 113(107 to 122); distance from dorsal to ventral 229 (213 to 240); distance from dorsal to anal 283(272 to 291); depth of caudal peduncle 86(79 to 91); distance from snout to dorsal 436(423 to 447); length of dorsal base 146(135 to 155); distance from snout to adipose 781(757 to 805); distance from snout

to anal 592(578 to 602); length of anal base 257(240 to 269); distance from snout to pectoral 290(279 to 300); distance from snout to ventral 401(398 to 419).

Vn present, moderate in size; Dn somewhat smaller, often hardly visible, embedded in the pigmented black tissue connecting the two organs. Op_1 small, opposite posterior tip of maxillary; Op_2 slightly larger than general body organs, separated from Op_1 by a space markedly greater than its own diameter. PLO about twice as close to pectoral base as to lateral line. PVO_1 directly above PO_2, about on a line connecting PO_1 and PVO_2 which is at base of lower pectoral rays and over or slightly in advance PO_3. Five PO; PO_1 slightly behind Op_2, the two organs nearly or often touching the same vertical; first interspace equal to or very slightly greater than the second, markedly greater than third which is the smallest and about an organ diameter smaller than fourth; from ventral view the anterior four organs form very gently diverging lines, fifth pair more abruptly divergent, located just in advance of base of outer ventral rays. VLO on a vertical somewhat closer to VO_1 than to VO_2, about on the same level as PVO_2, midway between it and SAO_2. Four VO about equally spaced or often the first interspace very slightly enlarged; VO_1 just posteromesad to base of inner ventral rays; from ventral view all organs form two nearly parallel straight lines. SAO somewhat angulated; SAO_1 directly over or slightly in advance of last VO, forming an isoceles triangle with it and SAO_2 which is slightly below a line passing through PVO_2 and VLO; SAO_3 almost in contact with lateral line forming a steep oblique line with SAO_2 and last VO, usually equidistant from VLO and Pol. Seven (6 to 8)+4(3 to 5) AO; the first organ usually slightly depressed, all interspaces subequal except the first which is somewhat enlarged; first AOp directly over or very slightly in advance base of last anal ray, separated from last

TABLE 13.—*Showing the variation in number of photophores in Myctophum pristilepis based on 41 specimens (both sides counted).*

		AOa		
		6	7	8
AOp	3	0	4	2
	4	2	65	4
	5	5	0	0

AOa by a space equal to about 0.5 depth of caudal peduncle. A single Pol directly over last AOa, nearly touching lateral line. Prc_1 near ventral body margin, separated from last AOp by a space equal to last AOa–AOp_1 interspace, or markedly greater than it when the AOp number is less than four. Prc_2 distinctly elevated but clearly nearer base of lower caudal rays than to lateral line. Adult males have 2(1 to 3) supracaudal luminous glands whose margins are rather heavily pigmented; these occupy the dorsal margin directly above the last AOp–Prc_1 interspace or may extend very slightly beyond it both anteriorly and posteriorly. Adult females have 1(1 to 2) smaller infracaudal luminous glands with much less heavily pigmented margins, located at the middle of the last AOp–Prc_1 interspace.

This particular species bears a striking resemblance to *Myctophum brachygnathos* and may easily be confused with it, particularly when juvenile specimens are being considered. The best differentiating character is the distance between the hind border of the orbit and the upper posterior edge of the opercular margin which is about equal to or less than the diameter of the orbit in this species and never greater as in *M. brachygnathos*. In addition, the upper opercular border is smooth in this species and denticulate in specimens of *M. brachygnathos* 35 mm in standard length or larger. When adult specimens are compared directly, the scales of *M. pristilepis* are much more strongly ctenoid than are those of *M. brachygnathos*.

5. MYCTOPHUM SPINOSUM (Steindachner).

Scopelus spinosus STEINDACHNER (1867) 11, *pl. 3, figs. 4, 4a* (China).
Scopelus (*Dasyscopelus*) *spinosus* LÜTKEN (1892) 239, *pl. 1, figs. 1, 2.*

Dasyscopelus spinosus GOODE and BEAN (1895) 92; GILBERT (1913) 73.

Myctophum (*Myctophum*) *spinosum* BRAUER (1904) 389; (1906) 196, *figs. 113, 114.*

Myctophum spinosum WEBER (1913) 87; WEBER and DE BEAUFORT (1913) 163.

Body robust throughout, narrowing abruptly under adipose fin. Upper anterior profile of head marked by slight depressions or concavities over orbital region. Snout bluntly rounded and steep in adults but moderately pointed and somewhat

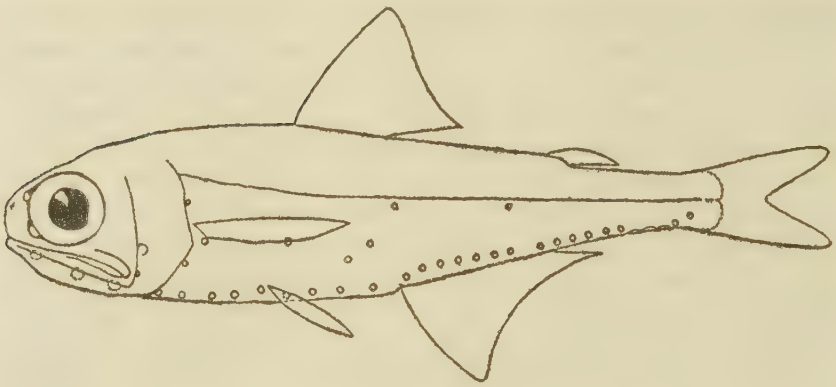


FIG. 8. *Myctophum spinosum* (Steindachner).

protruding in young individuals. Mouth terminal in adults but barely inferior in immature specimens. Posterior third of maxillary expanded, its end bluntly rounded, its postero-ventral margin curved slightly downward, extending well beyond hind margin of orbit, about 0.3 of its length lying behind a perpendicular to mouth drawn through posterior margin of eye. Eye rather large, orbital diameter about 2.5 times in head; upper orbital margin well developed, edge of the frontal extending anteriorly as a well defined ridge as far as the vertical of anterior orbital margin. While the head and the maxillary of this species become proportionately smaller with advancing age, the orbit increases in diameter. Upper margin of opercle dentate except in very young specimens, lower portion ending in a blunt point, sometimes almost evenly rounded below pectoral base. Gill rakers moderately long and heavy, those at angle equal to about 0.5 diameter of orbit; 6(6 to 7)+1+15(14 to 17) on first arch (10 specimens counted).

Fin formula.—D. 13(13 to 14); A. 20(17 to 21); P. 15(14 to 17); V. 8. Dorsal origin on a vertical about midway between margin of orbit and adipose base; dorsal base 1.7(1.5 to 1.8) in anal base. Anal origin directly under or slightly posterior to end of dorsal base. Pectoral base about midway between hind margin of orbit and dorsal origin; fin extending to or beyond SAO_1. Ventral base well in advance of dorsal origin, midway between hind margin of preopercle and anal origin; fin extending to VO_4. Scales strongly ctenoid, except in very young, the spination usually clearly visible in specimens 20.0 mm in standard length. Particular characteristic is the row of enlarge spines on the scales covering the AO photophores,

which collectively form a prominent longitudinal spinous line immediately below these organs; 38 to 39+1 scales in lateral line.

Measurements in per mille of standard length based on ten specimens 14.9 to 80.1 mm (average 50.7 mm) in standard length from nine stations: length of head 271(256 to 296); length of maxillary 170(157 to 188); diameter of orbit 101(73 to 108); distance from dorsal to ventral 225(208 to 257); distance from dorsal to anal 262(242 to 288); depth of caudal peduncle 74(68 to 81); distance from snout to dorsal 434(420 to 443); length of dorsal base 141(132 to 163); distance from snout to adipose 759(726 to 792); distance from snout to anal 567(541 to 600); length of anal base 231(222 to 252); distance from snout to pectoral 281(262 to 302); distance from snout to ventral 395(367 to 419).

A small Dn above level of nasal opening and a Vn clearly visible about on or slightly above level of maxillary tip; the two organs connected by an apparently tubular streak of black tissue bordering the orbit anteriorly. This connecting streak is more conspicuous in smaller individuals of about 25.0 mm in standard length, than it is in adults. Op_1 small, often barely visible, embedded opposite lower posterior angle of maxillary; Op_2 much larger than any of the neighboring organs, separated from Op_1 by a distance about equal to or often greater than its own diameter. PLO directly above or slightly behind PVO_1, closer to pectoral base than to lateral line. PVO_1 directly over PO_2, on a line connecting PO_1 and PVO_2 which is below and in contact with lower end of pectoral base and well in advance of PO_3. Five PO; PO_1 slightly behind Op_2; PO_5 immediately anterior to base of outer pelvic rays; first two PO interspaces subequal and a little larger than the fourth interspace, while the third interspace is smallest; occasionally the first, second, and fourth interspaces are subequal, but the third is always the smallest; from ventral view the PO organs usually diverge posteriorly in straight lines or occasionally, the middle three organs may form parallel lines, the first organs being displaced slightly toward the midline, the last abruptly divergent and located just in front of ventral origin. VLO about over or slightly behind posterior end of pelvic base, and closer to lateral line than to pelvic fin. Four VO, the first three evenly spaced, the last interspace somewhat larger than the first two; VO_1 slightly displaced medially, just posteromesad to base of inner ventral rays, the last three organs forming straight lines. SAO

forming a nearly straight line or very obtuse angle with the opening directed forward; SAO_1 over or slightly behind VO_3; SAO_2 somewhat variable in position but usually directly over VO_4, and noticeably closer to SAO_1 than to SAO_3; SAO_3

TABLE 14.—*Showing the variation in number of AO photophores in Myctophum spinosum based on 178 specimens (both sides counted).*

AOp \ *AOa*	6	7	8
5	0	6	5
6	3	103	38
7	11	159	18
8	5	8	0

directly over or slightly in advance of anal origin. Seven (6 to 8)+7(6 to 8) AO about evenly spaced; first one or two AOa noticeably depressed; AOp_1 well in advance of posterior end of anal base, occasionally directly over base of next to last anal ray, separated from last AOa by an interspace equal to about 0.5 depth of caudal peduncle. A single Pol directly over last AOa, well in front of adipose fin and almost in contact with lateral line. Prc_1 near ventral body margin, separated from last AOp by a space 1.1 to 2.0 times as wide as that between last AOa and first AOp, this space usually wide when the number of AOp is low; Prc_2 slightly elevated but markedly closer to base of lower caudal rays than to lateral line. A line of 3(1 to 7) supracaudal luminous glands, each one outlined in black, extending from adipose fin to base of upper cuadal ray or vertical of Prc_1 in males. In females, 3(1 to 4) glands similar in structure but smaller in size occur infracaudally and extend from the last AOp to the base of the lowest procurrent caudal ray or to vertical of Prc_1. These glands lie in a strictly median series. However, one specimen 80.9 mm in standard length, apparently normal in all other respects, displayed an unusual laterally displacement of its much reduced five infracaudal glands which tended to be arranged alternately on both sides of the midline. Occasionally female individuals may have both the supra- and infracaudal glands. This phenomenon appears to be much more common in *Myctophum spinosum* than in the other species of Myctophidae. The caudal glands apparently develop in both males and females at a standard length of 40 to 50 mm. The largest specimen in my material without caudal glands is 47.6 mm

in standard length while the smallest one with glands developed is a female 44.3 mm in standard length. Two individuals 85.2 and 90.0 mm in standard length have only one and two ventral glands respectively, while another, 48.0 mm in standard length, has two somewhat less developed infracaudal glands. One male individual with seven supracaudal glands has a standard length of 64.4 mm while many males over 70 mm in standard length have only three glands. The above indicates, therefore, that age is not a factor influencing the number of caudal glands that an individual may possess. The larger specimens generally have a bigger and better developed caudal glands than those of the smaller individuals.

On the basis of the available hydrographic data from 41 stations where 151 specimens were captured, it is possible to reach some estimates regarding the ecological preference of this species. Below 26°C (25.74°C, the coldest among 75 stations occupied) or above 30°C, not a single specimen was captured. However these temperature ranges occurred at only three stations. Between 26 and 36°C, the species is apparently common. There is no strong evidence that any limited temperature within the range is preferred, since both percentage of positive stations and average number of fish per station fluctuates rather widely with no evident trend.

TABLE 15.—*Showing the average catch of Myctophum spinosum at different ranges of temperature.*

Temperature	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Degrees centigrade			*Per cent*		
30.1 to 30.5	2	0	0	0	0
29.6 to 30.0	7	5	71	16	2.3
29.1 to 29.5	17	9	53	35	2.1
28.6 to 29.0	29	14	48	63	2.2
28.1 to 28.5	4	1	25	6	1.5
27.6 to 28.0	4	4	100	11	2.8
27.1 to 27.5	2	1	50	5	2.5
26.6 to 27.0	4	2	50	4	1.0
26.1 to 26.5	5	4	80	18	3.6
Less than 26.0	1	0	0	0	0

Table 16 presents evidence in regard to salinity. The lower limit of salinity tolerance could not be determined with accuracy due to lack of adequate data. The single station which showed a salinity of less than 33 parts per mille (32.63 parts per mille) was negative. At six stations where the salinity ranged from 33.01 to 33.40 parts per mille, 50 per cent of the stations were positive, and the average catch was 1.5 fish per station. These values are probably abnormally high, the small

number of stations not providing an adequate sample. The 29 per cent of positive stations and the average catch of 0.5 fish per station at the salinity range 33.41 to 33.80 parts per mille are probably more normal. From this point both indexes of population density show rising values with increasing salinity. These correlations indicate that *Myctophum spinosum* prefers water of high salinity, but the maximum salinity tolerated undoubtedly lies well outside the limits encountered, and even the optimum salinity may be above the highest values recorded at any of the stations occupied.

TABLE 16.—*Showing the average catch of Myctophum spinosum at different ranges of salinity.*

Salinity	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Parts per mille			*Per cent*		
34.21 to 34.60	18	12	67	68	3.8
33.81 to 34.20	36	21	58	73	2.0
33.41 to 33.80	14	4	29	7	0.5
33.01 to 33.40	6	3	50	9	1.5
32.61 to 33.00	1	0	0	0	0

Evidently, the preference of this species for water of high salinity explains the fact that it is taken much more commonly in the Celebes Sea (70 per cent of all stations occupied) than in the less saline Sulu Sea (31 per cent of all stations occupied). It is a curious fact, that in the China Sea, with a comparatively low salinity, 60 per cent of the stations were positive, but since only five stations were occupied, the results may not be convincing.

Myctophum spinosum may be found in truly marine waters characterized by surface temperatures between 26° to 30°C and salinity not lower than 33 parts per mille.

6. MYCTOPHUM LYCHNOBIUM Bolin.

Myctophum lychnobium BOLIN (1946) 137, *fig. 1* ("Investigator" station 670, 5° 56′ N., 76° 22′ E., off Cape Cormorin, India).

Myctophum (*Myctophum*) *lychnobium* FRASER-BRUNNER (1949) 1057, *fig.*

Body robust anteriorly, narrowing rather abruptly in the region of the adipose fin, caudal peduncle rather slender. Upper anterior profile of head marked by slight concavities or irregular depressions between the verticals of the nasal organs and upper end of the preopercular margin. Snout

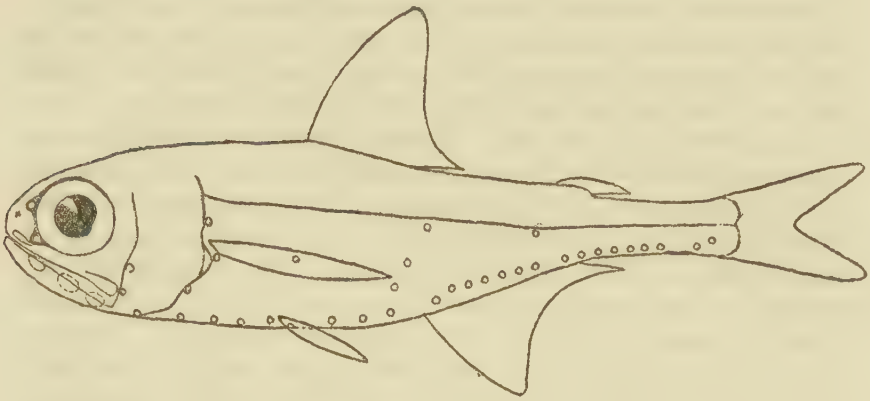


FIG. 9. *Myctophum lychnobium* Bolín.

steep and bluntly pointed, mouth strictly terminal in adults; in young specimens, the snout is more sharply pointed and somewhat protruding, the mouth slightly but definitely inferior. Maxillary slightly expanded posteriorly, its posteroventral margin curved slightly downward, its end sharply rounded, extending well beyond hind margin of orbit, about 0.2 of its length in adults (89.5 mm in standard length), about 0.3 or 0.4 in juveniles (25.3 mm in standard length) lying behind a perpendicular to mouth drawn through posterior margin of orbit. Eye rather large, orbital diameter 2.6 to 3.2 in head, proportionately larger in large specimens than in small ones, upper orbital margin prominent, edge of frontal extending anteriorly as a well defined ridge as far as the vertical of anterior orbital margin. Upper margin of opercle dentate, the spination clearly visible in the smallest individual (25.3 mm in standard length) examined, lower portion marked by a bluntly pointed flap just below pectoral base, almost evenly rounded ventrally. Gill rakers moderately long, those at angle equal to about 0.5 diameter or orbit; 7(6 to 7) + 1 + 15 on first arch.

Fin formula.—D. 13(13 to 14); A. 19; P. 15(15 to 16); V. 8 Dorsal origin on a vertical about midway between anterior margin of orbit and tip of adipose fin; dorsal base 1.8(1.6 to 2.0) in anal base. Anal origin about under end of dorsal base. Adipose slightly in advance posterior end of anal base. Pectoral base about midway between hind margin of orbit and dorsal origin; fin extending to or beyond SAO_1. Ventral base only slightly anterior to dorsal origin; fin extending almost or quite to VO_4. Scales strongly ctenoid except

in immature specimens where spination is usually not recognizable, 38 to 39+1 in lateral line. Of special interest is the row of enlarged spines on the scales covering the AO photophores which resembles that of *Myctophum spinosum.*

Measurements in per mille of standard length based on three specimens 25.3 to 89.5 mm (average 52.9 mm) in standard length from two available stations: length of head 266(250 to 285); length of maxillary 176 (165 to 186); diameter of orbit 95(83 to 111); distance from dorsal to ventral 228(217 to 250); distance from dorsal to anal 262(237 to 283); depth of caudal peduncle 72(69 to 75); distance from snout to dorsal 424(415 to 440); length of dorsal base 138(130 to 145); distance from snout to adipose 748(735 to 770); distance from snout to anal 545(523 to 583); length of anal base 240(226 to 253); distance from snout to ventral 380(364 to 400).

A small Dn directed forward and a slightly larger oval Vn directed downward, the two organs connected by a heavily pigmented tubular streak of black tissue which borders the eye anteriorly. As in *Myctophum spinosum,* this connecting streak is easily recognizable in young individuals of about 25.0 mm in standard length; since the eyes in young specimens are small, the streak is proportionately thicker and more prominent than that found in adults. It is interesting to note that there is a longitudinal streak of translucent and presumably luminous tissue between the nostril and premaxillary and extending posteriorly to the vertical of the anterior margin of orbit adjacent to Vn in the adult. This is not present in the two younger specimens. Op_1 small, hardly visible, embedded opposite lower posterior end of maxillary; Op_2 slightly larger than neighboring organs, separated from Op_1 by a distance equal to one or two times its own diameter. The older the individual, the farther the Op_2 from Op_1. PLO slightly behind PVO_1, distinctly closer to pectoral base than to lateral line. PVO_1 directly over or slightly behind PO_2, on a line connecting PO_1 and PVO_2 which is at the base of the lower pectoral rays and about over PO_3. Five PO; PO_1 slightly behind Op_2; PO_5 immediately anterior to base of outer pelvic rays; first one or two PO interspaces slightly larger than the last two or three; from ventral view, the first, second, third, and fifth organs form gently diverging straight lines, the fourth organs slightly displaced toward the midline. VLO slightly higher than PVO_2 and directly above posterior end of

pelvic base, somewhat closer to lateral line than to pelvic fin. Four VO about evenly spaced, or with the first interspace often larger than the last two; VO_1 just posteromesad to base of inner pelvic rays. SAO forming a straight line which passes through the third VO interspace. SAO_1 about over VO_4, sometimes slightly behind and sometimes slightly in front of it; SAO_2 about one and a half times closer to SAO_1 than to SAO_3 which is about over anal origin and almost in contact with lateral line. AO 7 + 7, about evenly spaced; AOa_1 depressed, its upper edge about on a line passing through the ventral margins of the remaining organs in the series; AOp_1 directly over base of next to last anal ray, separated from last AOa by an interspace equal to or somewhat less than half depth of caudal peduncle. A single Pol directly over last AOa, well in advance of adipose base and in contact with lateral line. Prc_1 near ventral body margin, separated from last AOp by an interspace markedly wider than that between last AOa and first AOp; Prc_2 slightly elevated but somewhat closer to base of lower caudal rays than to lateral line. Two infracaudal luminous glands present in the only adult female known.

Color a rather deep brownish-black which differs strikingly from the lighter color of all of the other Philippine species described in this paper. Fins paler.

Myctophum lychnobium is very close to *Myctophum spinosum* and may actually proved to be conspecific. However, the three specimens discussed here differ from the 179 available specimens of *M. spinosum* in having the SAO_1 instead of the SAO_2 directly over or slightly anterior to VO_4. The single adult shows a longitudinal streak of translucent and probably luminous tissue between the nostrils and premaxillary which is not present in *M. spinosum*. This specimen is slightly heavier anteriorly and more slender posteriorly than *M. spinosum* of slightly smaller but still comparable size, and the color is markedly darker than in specimens of the latter species taken by the same investigators and presumably preserved in the same way. Under the circumstances, I feel justified in tentatively maintaining it as a distinct form.

7. MYCTOPHUM EVERMANNI Gilbert.

Myctophum evermanni GILBERT (1905) 597, *pl. 70, fig. 2* ("Albatross" station 3980, south of Oahu, Hawaii); (1913) 80; WEBER (1913) 87; WEBER and DE BEAUFORT (1913) 162, *fig. 63;* PARR (1928) 65; BEEBE and VANDER PYL (1944) 73.

Myctophum (*Myctophum*) *evermanni* BRAUER (1906) 162.
Myctophum (*Scopelus*) *evermanni* FRASER-BRUNNER (1949) 1055, *fig.*

Body robust, tapering rather evenly from vertical of dorsal origin to moderately heavy caudal peduncle. Upper anterior profile gently rounded or slightly depressed above eyes; snout

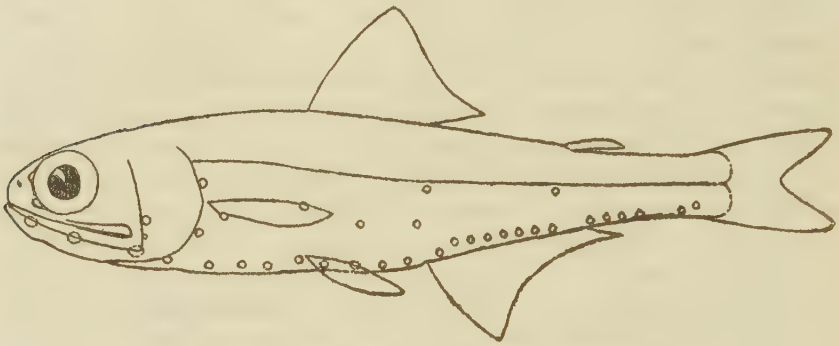


FIG. 10. *Myctophum evermanni* Gilbert.

moderately steep and rounded; mouth terminal; lower jaw very slightly protruding. Maxillary slightly expanded posteriorly, its hind margin, forming an oblique curve, the upper angle well in advance of the lower, extending well beyond eye, about 0.3 of its length lying behind a perpendicular to mouth drawn through posterior margin of orbit. Eye rather large, orbital diameter about three times in head. In the younger stages of this species the head, eye, and maxillary are proportionately larger than in the adult. Opercular margin ending in an obtuse angular point above or directly in front of pectoral base, lower margin broadly rounded. Gill rakers long and slender, those at angle equal to about 0.5 diameter of orbit; 6(5 to 7)+1+16(14 to 17) on first arch (10 specimens counted).

Fin formula.—D. 14(14 to 16); A. 20(20 to 21); P. 15(15 to 16); V. 8. Dorsal origin directly above ventral or midway between snout and a point somewhere near second AOp; dorsal base 1.4(1.3 to 1.6) in anal base. Anal origin directly below or slightly in advance of posterior end of dorsal base. Adipose slightly in advance of posterior end of anal base and directly over anterior part of AO interspace. Pectoral base slightly closer to dorsal origin than to posterior edge of orbit, fin extending to or slightly beyond VO_1. Ventral base directly

under dorsal origin or the VLO; fin extending to or beyond VO_4. Scales cycloid, 37 to 40 + 1 in lateral line.

Measurements in per mille of standard length based on ten specimens 21.3 to 79.6 mm (average 62.0 mm) in standard length from ten widely separated stations: length of head 282(261 to 300); length of maxillary 188(175 to 211); diameter of orbit 104(94 to 115); distance from dorsal to ventral 196(186 to 212); distance from dorsal to anal 249(232 to 266); depth of caudal peduncle 82(80 to 86); distance from snout to dorsal 438(427 to 448); length of dorsal base 167(146 to 176); distance from snout to anal 590(577 to 607); length of anal base 238(226 to 250); distance from snout to pectoral 296(272 to 324); distance from snout to ventral 427(412 to 441).

A Vn, moderate in size, embedded between maxillary and lower frontal margin of orbit. A smaller rather diffuse and inconspicuous Dn above nasal sac. Op_1 as large as ordinary body photophores but deeply embedded, often indistinct, opposite lower posterior angle of maxillary; Op_2 a little larger than neighboring organs slightly above level of PVO_1 separated from Op_1 by a space equal to or somewhat greater than its own diameter. PLO directly above or often very slightly behind PVO_1, midway between the lateral line and the upper end of pectoral base or often nearer the lateral line. PVO_1 in advance of PO_2, about on a line connecting PO_1 and PVO_2 which is at the base of lower pectoral rays and well in advance of PO_3. Five PO; PO_1 well behind Op_2, interspaces variable, the first usually widest and the third shortest but occasionally the first, second, and fourth interspaces are subequal; from ventral view the PO organs usually form straigtht lines which diverge posteriorly, but often the middle three organs may form parallel lines, the first organs displaced slightly toward the midline, the last abruptly divergent and located just in advance of and very slightly mesad the base of outer ventral rays. VLO about over anterior end of ventral base or slightly behind PO_5. Four VO; the first two interspaces subequal and greater than third. VO_1 just posteromesad to inner ventral rays, forming straight lines with next two organs, VO_4 very slightly displaced laterally. SAO strongly angulated; SAO_1 somewhat behind VO_2, well below level of VLO; SAO_2 slightly behind VO_4 and about on same level as SAO_1, SAO_3 slightly below lateral line, directly under base of last dorsal ray,

about on a line, connecting VO_4 and SAO_2. Eight (6 to 9) + 5(3 to 6) AO about evenly spaced; first AOa noticeably depressed; AOp_1 about over or slightly behind base of last

TABLE 17.—*Showing the variation in number of AO photophores in Myctophum evermanni based on 612 specimens (both sides counted).*

		AOa			
		6	7	8	9
AOp	3	0	0	0	2
	4	0	11	46	21
	5	2	38	922	59
	6	0	34	86	3

anal ray, separated from last AOa by a space about equal to 0.5 depth of caudal peduncle or slightly less. A single Pol directly over or often somewhat behind last AOa and very slightly below lateral line. Prc_1 near ventral body margin, separated from last AOp by a space about equal or greater than the space between last AOa and first AOp; Prc_2 slightly elevated but much nearer base of lower caudal rays than lateral line, separated from Prc_1 by a space equal to interspaces of AO. In adult males, a line from four to seven supracaudal luminous glands, each one outlined in black, the anterior margins wider and more heavily pigmented than the posterior, extending from adipose fin to or almost to vertical of Prc_1. In females, one to six infracaudal glands are present; they usually extend from the second or third AOp to the base of the lowest procurrent caudal ray, but if only one is present, it may originate entirely behind the AO series. These glands are much smaller than those of the males and lie in a strictly median series. The caudal glands begin to develop in males upon reaching a standard length of from 32 to 35 mm and in females from 41 to 51 mm in standard length. The number of caudal glands is not affected by age except during the period of their first appearance, when small males, 32 to 40 mm in standard length often have only three poorly developed glands.

This is seemingly the most common species of lantern fish found in Philippine waters. A total of 613 specimens were captured during the night light operations here reported upon. With the availability of hydrographic data from numerous localities (50 stations), a moderately accurate assessment of some of the ecological requirements of this species is made possible. The coldest surface temperature at which this species was collected was 26.34°C, and at this station only a single

specimen was taken. Table 18 shows that five of the six stations whose temperature went below 26.5°C were negative, indicating that the minimum temperature tolerated by *Myctophum evermanni* is approximately 26.0°C. In the temperature range of 26.6 to 27.5°C, the species was fairly common, but the average number of specimens was only 1.8 per station. At the stations where the temperature ranged between 27.6 and 30.0°C, the species appeared to find optimum conditions (9.2 fish per station). There is an indication of an abrupt decline in number of specimens in water above 30.0°C, but since such temperatures were found at only two stations, the evidence is not convincing.

TABLE 18.—*Showing the catch of Myctophum evermanni at different ranges of temperature.*

Temperature	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Degrees centigrade			*Per cent*		
30.1 to 30.5	2	1	50	1	0.5
29.6 to 30.0	7	7	100	82	11.7
29.1 to 29.5	17	8	47	236	13.8
28.6 to 29.0	29	22	76	188	6.5
28.1 to 28.5	4	3	75	19	4.8
27.6 to 28.0	4	3	75	34	8.5
27.1 to 27.5	2	1	50	2	1.0
26.6 to 27.0	4	4	100	9	2.3
26.1 to 26.5	5	1	20	1	0.2
Less than 26.0	1	0	0	0	0

Table 19 presents similar evidence with regard to salinity. Since only one station shows a salinity as low as 33 parts per mille, it may not be justifiable to conclude, although this station was negative, that such a salinity represents the lower limit of tolerance of this organism. Both the percentage of positive stations and the number of captured fish per station increases as the salinity rises. This positive correlation extends throughout the entire range of salinities encountered, so that no definite estimate of the upper limit of salinity tolerance can be made. As a result of the preference of this species

TABLE 19.—*Showing the catch of Myctophum evermanni at different ranges of salinity.*

Salinity	Number of stations	Stations positive	Station positive	Number of specimens	Fish per station
Parts per mille			*Per cent*		
34.21 to 34.60	18	14	78	177	9.8
33.81 to 34.20	36	23	64	330	9.2
33.41 to 33.80	14	10	71	45	3.2
33.01 to 33.40	6	3	50	20	3.3
32.61 to 33.00	1	0	0	0	0

for waters of comparatively high salinity, we may expect it to be particularly characteristic of the open oceanic waters. This tends to explain why the species is so common in the Celebes Sea where it was taken at 80 per cent of all the stations occupied, while it is only about half as common in the more restricted and less saline Sulu Sea where it was found at only 46 per cent of the stations. In the Pacific Ocean it was taken at all four stations occupied; this is in full accord with the theory here presented, especially since the average catch per station was 11.25 individuals. It is somewhat curious that specimens were taken at four of the five stations occupied in the China Sea, with its comparatively low salinity. However, the average catch for these stations was only 1.8 individuals.

It may be stated that *Myctophum evermanni* may be expected to occur in waters which register a surface temperature of more than 26.5°C and a salinity higher than 33 parts per mille.

3. Genus HYGOPHUM (Tåning) Bolin

Hygophum TÅNING (1932) 133 [genotype by subsequent designation of Bolin (1939), *Scopelus hygomi* Lütken].

Teeth in narrow cardiform bands on premaxillaries and dentaries; vomer bearing on each side a strongly protruding lobe devoid of teeth, but with a few minute teeth on its median area just posterior to the lobes; very narrow long bands of cardiform teeth on palatines and a large oval area of scattered, minute teeth on entopterygoids. Pectoral base high, its upper end about equidistant from dorsal and ventral margins. Four VO, the second not elevated; two Pol; AO interspace in advance of end of anal base, at least two AOp over posterior end of anal; Prc_2 markedly elevated, usually close to or in contact with lateral line. Supra- and infracaudal luminous glands distinctly subdivided. No pterotic spine.

Members of this genus are at once recognizable by the possession of two Pol arranged obliquely, the high second Prc, and the unusual vomerine dentition.

HYGOPHUM REINHARDTII (Lütken).

Scopelus reinhardtii LÜTKEN (1892) 257 (in part), *fig. 16* (off Madeira).

Myctophum reinhardtii GOODE and BEAN (1895) 74.

Myctophum benoiti reinhardti BRAUER (1904) 388; WEBER (1913) 86; WEBER and DE BEAUFORT (1913) 155.

Myctophum (*Myctophum*) *benoiti reinhardti* BRAUER (1906) 185, *figs. 96–101.*

Myctophum reinhardti PARR (1928) 66; BEEBE and VANDER PYL (1944) 77, *fig. 10.*
Myctophum (*Hygophum*) *reinhardtii* BOLIN (1939) 113, *fig. 12.*
Hygophum reinhardti FRASER-BRUNNER (1949) 1050, *fig.*

Body robust throughout, tapering gently from dorsal origin to a rather short and moderately heavy caudal peduncle. Snout steep, bluntly pointed; mouth terminla, lower jaw

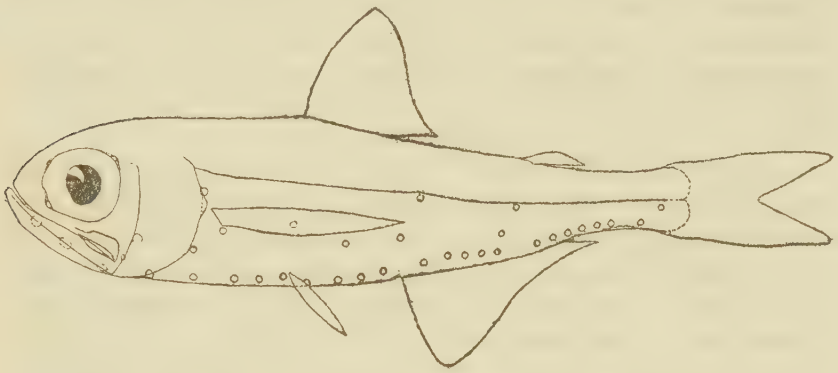


FIG. 11. *Hygophum reinhardtii* (Lütken).

slightly protruding. Maxillary rather short, about 0.25 of its length lying behind a perpendicular to mouth drawn through posterior border of orbit; conspicuously widened posteriorly, both its upper and lower margins abruptly expanded, the latter extending mesad to, and well below the posterior part of premaxillary. Eye large, orbital diameter 2.3 (2.1 to 2.5) in head. Opercular margin evenly rounded, except for a sharply pointed flap, easily visible in undamaged specimens in the region directly in front of pectoral base. This pointed flap is more prominent in juvenile specimens ranging from 12 to 17 mm in standard length than in adults. Gill rakers 4(4 to 5)+1+13 (13 to 14) on first arch; those at angle equal to about 0.5 diameter of orbit.

Fin formula.—D. 13(13 to 14); A. 20(19 to 20); P. 13 (12 to 14); V. 8. Dorsal origin on a vertical midway between center of orbit and base of adipose fin; dorsal base 1.8 (1.6 to 1.9) in anal base. Anal origin directly below or very slightly behind posterior end of dorsal base. Adipose fin well in advance of end of anal base, approximately above base of fifth from last anal ray. Pectoral base about equidistant from tip of snout and anus, nearer to ventral than to dorsal body margin; fin extending about to SAO_2 or to anus. Ventral base slightly anterior to dorsal origin; fin extending beyond VO_3 or about to anus. Scales cycloid, 35(35 to 36) in lateral line.

Measurements in per mille of standard length based on ten specimens 13.1 to 39.0 mm (average 22.3 mm) in standard length from ten widely separated stations: length of head 295(278 to 308); length of maxillary 190(172 to 198); diameter of orbit 127(114 to 135); distance from dorsal to ventral 211(188 to 242); distance from dorsal to anal 250(219 to 282); depth of caudal peduncle 91(81 to 98); distance from snout to dorsal 449(428 to 470); length of dorsal base 151(138 to 166); distance from snout to adipose 777(757 to 790); distance from snout to anal 581(553 to 618); length of anal base 270 (236 to 286); distance from snout to pectoral 316(292 to 330); distance from snout to ventral 428(394 to 446).

A small Dn often hardly visible due to its being almost wholly enveloped by a dark pigmented streak along anterior orbital margin; a somewhat larger Vn and a small Suo. Op_1 small lying on the margin of preopercle opposite lower part of maxillary expansion; Op_2 markedly larger than neighboring organs, on a line tangential to lower margin of orbit from PVO_1, separated from Op_1 by a distance clearly greater than its own diameter. PLO a little anterior to base of pectoral, slightly nearer to it than to lateral line. PVO_1 usually directly over, sometimes somewhat in front of or behind PO_2, on a line connecting PO_1 and PVO_2 which is at base of lower pectoral rays and usually slightly in advance PO_3. Five PO; PO_1 behind Op_2, these two organs usually touching the same vertical; first two interspaces subequal, almost twice as large as third which is equal to or slightly smaller than the fourth; from ventral view the first four organs form gently diverging straight lines; the last pair more widely divergent, located just in front of and slightly mesad to base of outer ventral rays. VLO directly over or slightly behind pelvic base, markedly nearer to ventral than to dorsal body margin, almost on a line connecting PVO_2 and SAO_3. Four VO, very variably spaced but usually the first interspace is the largest; from ventral view, the four pairs of organs form two nearly straight lines diverging slightly posteriorly. SAO sharply angulated; SAO_1 slightly behind VO_2, usually midway between it and VO_3 (rarely nearer VO_3), on about the same level as PVO_2 and about an organ diameter below a line connecting VLO and SAO_2 which is about over anal origin and approximately on a line connecting SAO_1 and Pol_1; SAO_3 about touching lateral line, slightly anterior to first AO, on an oblique line connecting SAO_2 and VO_4. Six (4 to 7) + 6(5 to 7) AO; AO_1

and often AO_2 slightly depressed, all organs about evenly spaced or first interspace somewhat enlarged; first AOp directly under posterior end of adipose base, separated from last AOa by a space about 0.5 depth of caudal peduncle. Two Pol; Pol_1 directly over or slightly behind last AOa, about midway between next to last AOa and Pol_2 which is on a vertical below base of adipose fin and almost touching lateral line. Prc_1 near ventral body margin, about on the same level as last AOp, separated from it by a space about equal to or a little less than the

TABLE 20.—*Showing the variation in number of AO photophores in Hygophum reinhardtii based on 39 specimens (both sides counted).*

		AOa			
		4	5	6	7
AOp	5	0	0	1	0
	6	0	7	34	1
	7	1	23	10	1

distance between last AOa and first AOp; Prc_2 markedly elevated, immediately below lateral line or in contact with it, well behind Prc_1. There is a single mature male, 32.1 mm in standard length, which has a supracaudal luminous gland, extending from the posterior end of adipose base almost to the procurrent caudal rays. This gland is dotted over by dark granular pigment which makes the divisions of the gland hardly visible. In females 33.5 and 39.0 mm in standard length, 4 or 5 more distinctly separated infracaudal luminous glands extend from the last AOp interspace almost to Prc_1.

Table 21 shows the catch of *Hygophum reinhardtii* at different ranges of temperature. In the maximum temperature range (30.1 to 30.5°C) encountered, 100 per cent of the stations were positive and showed an average catch of 10.5 fish per station. Although based upon only two stations, the results which are much higher than those encounted at lower temperature ranges indicates that optimum conditions are found at these high temperatures or possibly even higher. From 30.0° down to 27.6°C, the percentage of positive stations and the average catch per station fluctuates rather widely and no convincing trend is indicated. At temperatures below 27.5°C there was no catch at all except at station B–560 (26.4°C) which yielded two specimens. It is probable that this temperature appromimates the lower limit of tolerance for this species.

TABLE 21.—*Showing the catch of Hygophum reinhardtii at different ranges of temperature.*

Temperature	Number of station	Stations positive	Station positive	Number of specimens	Fish per station
Degrees centigrade			*Per cent*		
30.1 to 30.5	2	2	100	21	10.5
29.6 to 30.0	7	1	14	1	0.1
29.1 to 29.5	17	4	24	5	0.3
28.6 to 29.0	29	2	7	4	0.1
28.1 to 28.5	4	1	25	1	0.2
27.6 to 28.0	4	2	50	2	0.5
27.1 to 27.5	2	0	0	0	0
26.6 to 27.0	4	0	0	0	0
26.1 to 26.5	5	1	20	2	0.4
Less than 26.0	1	0	0	0	0

Table 22 shows the catch of *Hygophum reinhardtii* at different ranges of salinity. The relatively high percentage of positive stations and the relatively large number of fish taken in the range between 33.81 and 34.20 parts per mille indicate that such salinity conditions are preferred by these organisms. There was an appreciable decrease in both percentage of positive stations and fish per station at ranges both above and below this optimum. The upper limit of salinity tolerance is not determinable from the data, but the fact that only a single specimen was taken at the 21 stations recording salinities below 33.80 parts per mille indicates that the salinity of 33.58 parts per mille recorded at the positive station approaches the minimum tolerated by this form.

TABLE 22.—*Showing the catch of Hygophum reinhardtii at different ranges of temperature.*

Salinity	Number of station	Stations positive	Station positive	Number of specimens	Fish per station
Parts per mille			*Per cent*		
34.21 to 34.60	18	3	17	3	0.2
33.81 to 34.20	36	9	25	32	0.9
33.41 to 33.80	14	1	7	1	0.1
33.01 to 33.40	6	0	0	0	0
32.61 to 33.00	1	0	0	0	0

The ecological factors of temperature and salinity probably account for the fact that these fish are more common in the warmer and more saline Sulu Sea (20 per cent of all stations occupied) than in the Celebes Sea (14 per cent of all stations occupied). Additional evidence, although based on only four stations occupied, is also suggested by results in the saline and fairly warm Pacific Ocean which registered 25 per cent positive stations. The China Sea had no catch at all which is in all probability due to cold temperature rather than the

salinity, since three stations occupied fall within the possible optimum salinity limit.

4. Genus DIAPHUS Eigenmann and Eigenmann

Diaphus EIGENMANN and EIGENMANN (1890) 3 (genotype by original designation *Diaphus theta* Eigenmann and Eigenmann).

Teeth on premaxilliaries, jaws and palatines in narrow bands; a large patch of minute teeth on each entopterygoid. Gill rakers well developed. Dn and Vn present, variously developed, the latter often enlarged or elongated, extending along the suborbital margin. Five PO; PO_4 markedly elevated. Five VO; the first three organs characteristically forming an oblique ascending straight line. AO in two distinct series; the first AOa may be elevated and the last one or two may be elevated to appear as additional members of the Pol series.

Members of this genus are easily recognized by the possession of four Prc, low origin of pectoral base, markedly enlarged Dn and Vn, and relatively heavy caudal peduncle.

DIAPHUS CHRYSORHYNCHUS Gilbert and Cramer.

Diaphus chrysorhynchus GILBERT and CRAMER (1896) 409 (station 286, surface tow net, lat. N. 21° 15′ 49″, long. W. 157° 44′ 27″, and from Iiao Makanni[1]); Parr (1928) 120.

Myctophum fibulatum GILBERT and CRAMER (1896) 409, *pl. 38, fig. 3* (typographical error).

Myctophum (*Diaphus*) *chrysorhynchum* BRAUER (1906) 164.

Myctophum (*Diaphus*) *chrysorhynchus* BRAUER (1906) 384.

Diaphus (*Lamprossa*) *chrysorhynchus* FRASER-BRUNNER (1949) 1073, *fig.*

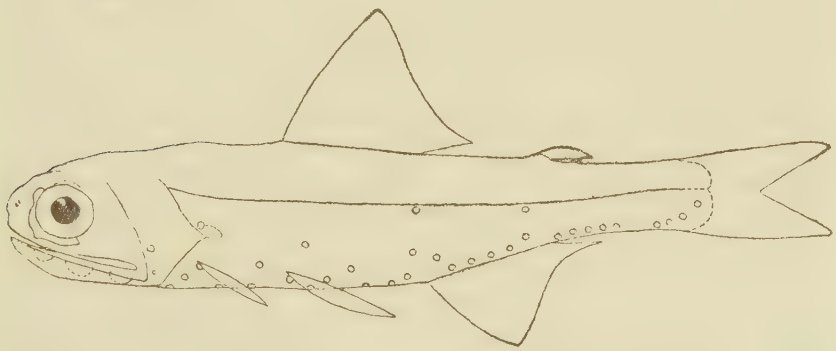


FIG. 12. *Diaphus chrysorhynchus* Gilbert and Cramer.

[1] The locality of "Iiao Makanni" is unknown to me. Fowler (1928) spelled it as "Iiao Makauni." A diligent search of a number maps and charts of the Hawaiian area reveals no place name with either spelling. It may be possible that the records refer to Kaumakani, Kauai.

Body heavy, dorsal and ventral contours roughly parallel anterior to the posterior end of the dorsal base, narrowing rather abruptly in anal region; caudal peduncle heavy. Upper anterior profile of head very slightly concave above anterior margin of eye; snout slightly rounded; mouth terminal. Maxillary almost without any expansion posteriorly; extending well beyond eye, over 0.4 of its length lying behind a perpendicular to mouth drawn through posterior margin of orbit. Eye moderate, orbital diameter 4.0(3.3 to 4.5) in head. Opercular margin ending in a sharp point below PLO. Gill rakers moderately long and slender those at angle about 0.6 diameter of orbit; 9(7 to 9) + 1 + 15(15 to 17) on first arch. The younger individuals have two undeveloped gill rakers at the beginning of the upper limb.

Fin formula.—D. 16(16 to 17); A. 15(15 to 16); P. 10 (10 to 11); V. 8. Dorsal origin midway between snout and base of adipose fin; dorsal base equal to or slightly longer than anal base. Anal origin directly below or somewhat behind end of dorsal base. Pectoral base midway between a line perpendicular to hind margin of orbit and pelvic base; fin extending about to ventral base. Ventral base almost directly under dorsal origin; fin extending to or almost to VO_5. Scales cycloid, 34 + 2 in lateral line.

Measurements in per mille of standard length based on three specimens 22.6, 37.5, and 76.4 mm in standard lengths from three available stations: length of head 304(295 to 318); diameter of orbit 88(69 to 97); length of maxillary 211 (203 to 221); distance from dorsal to ventral 188(180 to 195); distance from dorsal to anal 288(279 to 304); depth of caudal peduncle 106(100–110); distance from snout to dorsal 431 (420 to 442); length of dorsal base 201(186 to 210); distance from snout to anal 628(620–643); length of anal base 172 (163 to 182); distance from snout to adipose 785(779 to 795); distance from snout to pectoral 295(279 to 310); distance from snout to ventral 443(425–460).

A large double Dn (i.e., with anterior ethmoidal facet) about equal in size to the laminated rosette of nasal tissue. Dn and Vn not expanded forward to median line at ethmoidal crest, but joined to each other along anterior orbital border; Vn elongated, extending along suborbital margin to about a vertical from the hind end of pupil. Except for a small, rather diffuse dark area under the eye, the anterior and lateral surfaces of the head in front of the preopercular border and below

the supraorbital rim are almost entirely unpigmented and may possibly be luminous. A luminous scale immediately below PLO; this is very variable in size, smaller than the PLO in my smallest specimen, extending almost to the pectoral base in the specimen of intermediate size, and as figured in the largest individual. Op_1 small, opposite lower posterior angle of maxillary; OP_2 about equal in size to general body photophores, well above level of pectoral base and about at the same level as VLO, separated from Op_1 by an interspace equal to about one-third diameter of orbit. PLO directly over PVO_2 and directly nearer to lateral line than to base of pectoral. PVO_1 well behind PO_1, and about midway between it and PVO_2, the three organs forming a straight line. Five PO; PO_4 elevated, at a point on or just above a line between pectoral base and insertion of outer ventral ray, advanced to a position almost directly over or slightly behind PO_3; PO_1 well behind Op_2; first PO interspace about twice as wide as the second, which is equal to or somewhat larger than PO_3–PO_5 interspace; from ventral view, the first three and the last pair of organs, form two progressively diverging straight lines. VLO well behind base of outer ventral rays, midway between pectoral base and SAO_2. Five VO; VO_1 directly mesad to base of inner ventral rays; next two organs increasingly elevated, forming an ascending straight line with the first; first interspace smaller than second, VO_3 directly under middle of dorsal base, about on the same level as PO_4 or second AOa; last two pairs of VO forming parallel straight lines with first pair of VO; third and last interspace about equal to second SAO forming a steep and very obtuse angle or slightly curved series; SAO_1 behind and only slightly higher than last VO; SAO_2 about twice as close to SAO_1 as to SAO_3, about over anus and slightly above level of first AOa; SAO_3 almost touching lateral line, about on a line between posterior end of dorsal base and SAO_2. Six + 5 AO; first AOa strongly elevated, slightly below level of SAO_2 and clearly behind anal origin; last AOa also well elevated, about on the same level as first AOp or VLO and markedly in advance of adipose base. First AOp immediately behind posterior end of anal base, on the same level as the last AOa and separated from it by an interspace equal to about 0.4 depth of caudal peduncle. One Pol slightly in advance of adipose base, directly above last AOa, and almost in contact with lateral line. Four Prc; first Prc close to ventral body margin, separated from last AOp by an interspace greater by about an

organ diameter than that between last AOa and first AOp; all organs forming an ascending arc, the third interspace about half an organ diameter larger than the first two which are subequal.

This species, originally described from the Hawaiian area and hitherto unrecorded from Philippine waters, is represented in the collections by only two specimens from the Celebes Sea and one from the Sulu Sea. These fish represent an extension of approximately 4,830 miles in the known range of the species. Evidently it is a comparatively rare form in the Philippine seas.

LITERATURE CITED

BEEBE, W., and M. VANDER PYL. Eastern Pacific Expeditions of the New York Zoological Society: XXXIII. Pacific Myctophidæ (Fishes). Zoologica 29 (1944) 59–95.

BOLIN, R. L. A review of the myctophid fishes of the Pacific Coast of United States and of Lower California. Stanford Ichthyol. Bull. 1 (1939) 89–156, *figs. 1–9*

BOLIN, R. L. Lantern fishes from "Investigator" station 670, Indian Ocean. Stanford Ichthyol. Bull. 3 (1946) 137–152, *figs. 1–5.*

BLEEKER, P. Beschrijvingen van nieuwe of weinig bekende vischsoorten van Menado en Makassar. Act. Soc. Sci. Indo-Neerl. 1 (1856) 1–80.

BLEEKER, P. Atlas ichthyologique des Indes Orientales Neerlandaises. 6 (1875) 152.

BRAUER, A. Die Gattung Myctophum. Zool. Anz. 28 (1904) 377–404, *figs. 1–9.*

BRAUER, A. Die Tiefsee-Fische: I. Systematischer Teil. Wiss. Ergebnisse Deutsch. Tiefsee-Exped. Valdivia 1898–99 15 (1906) 1–432, *18 pls., 176 figs.*

CUVIER, G. L. C. F. D. Le règne animal 2 (1817) 1–532.

EIGENMANN, C. H. and R. S. EIGENMANN. Additions to the fauna of San Diego. Calif. Acad. Sci. Proc. 3 (1890) 1–24.

EVERMANN, B. W., and A. SEALE. Fishes of the Philippine Islands. U. S. Bur. Fish. Bull. 26 (1906) 49–110, *figs. 1–22.*

FOWLER, H W. Description of new lantern fish. Acad. Nat. Sci. Philadelphia Proc. 55 (1904) 754–755.

FOWLER, H. W. The fishes of the Oceania. Bishop Mus. Mem. 10 (1928) 1–540, *pls. 1–49, figs. 1–82.*

FOWLER, H. W. Descriptions of new fishes obtained 1907 to 1910, chiefly in the Philippine Islands and adjacent seas. Acad. Nat. Sci. Philadelphia Proc. 85 (1934) 233–367, *figs. 1–117.*

FOWLER, H. W. Results of the fifth George Vanderbilt Expedition (1941) (Bahamas, Caribbean Sea, Panama, Galapagos Archipelago, and Mexican Pacific Islands). Acad. Nat. Sci. Philad. Monogr. 6 (1944) i-iv + 1–583, *20 pls., 268 text-figs.*

FRASER-BRUNNER, A. A classification of the fishes of the family Myctophidæ. Zool. Soc. Proc. (4) 118 (1949) 1019–1106, *1 pl., 167 figs.*

GARMAN, S. Reports on an exploration off the west coasts of Mexico, Central and South America, and off the Galapagos Islands, etc. XXVI. The Fishes. Mus. Comp. Zool. Harvard Mem. 24 (1899) 1–431, *pls. 1–85,* A-N.

GILBERT, C. H. The deep-sea fishes of the Hawaiian Islands. U. S. Fish. Comm. Bull. 23 (1905) i–xi, 577–713, *pls. 66–101, text-figs. 230–276.*

GILBERT, C. H. Certain scopelids in the collection of the Museum of Comparative Zoology. Mus. Comp. Zool. Harvard Bull. (14) 46 (1906) 255–263, *3 pls.*

GILBERT, C. H. Notes on lantern fishes from southern seas, collected by J. T. Nichols in 1906. Amer. Mus. Nat. Hist. Bull. (2) 30 (1911) 13–19.

GILBERT, C. H. The lantern fishes of Japan. Carnegie Mus. Pittsburgh Mem. 6 (1913) 67–107, *pls. 11–14.*

GILBERT, C. H., and F. CRAMER. Report on fishes dredged in deep water near the Hawaiian Islands, with descriptions and figures of twenty-three new species. U. S. Nat. Mus. Proc. 19 (1896) 403–435, *pls. 36–48.*

GOODE, G. B., and T. H. BEAN. Oceanic ichthyology. U. S. Nat. Mus. Special Bull. (1895) xxxv + 1–553, *123 pls.*

GÜNTHER, A. C. G. Sweiter Ichthyologischer Beitrag Exemplaren aus dem Museum Godeffroy. Jour. Mus. Godeffroy, Band I, Heft IV (1873) 265–268.

GÜNTHER, A. C. L. G. Report on the pelagic fishes collected by H. M. S. Challenger during the years 1873–76. Challenger Repts. 31 (1889) 1–47, *6 pls.*

HERRE, A. W. C. T. Twenty-six noteworthy Philippine fishes. Philip. Jour. Sci. 79 (1950) 137–154.

LÜTKEN, C. F. Korte Bidrag til nordisk Ichthyographi. Nogle nordiske Laxesild (Scopeliner). Vidensk. Meddel. naturh. Foren. Copenhagen 8 (1891) 203–233.

LÜTKEN, C. F. Spolia Atlantica. Scopelini Musei Zoologic Universitatis Hauniensis. Vidensk, Selsk. Skrift., Copenhagen § 6 7 (1892) 220–297, *26 figs., 3 pls.*

PARR, A. E. Deep-sea fishes of the order Iniomi from the waters around the Bahama and Bermuda Islands with annotated keys to the Sudidæ, Myctophidæ, Scopelarchidæ, Evermannelidæ, Omosudidæ, Cetomimidæ and Rondeletidæ of the world. Bingham Oceanogr. Coll. Bull. (3) 3 (1928) 1–193, *43 figs.*

PARR, A. E. Notes on the species of myctophine fishes represented by type specimens in the United States National Museum. U. S. Nat. Mus. Proc. (10) 76 (1929) 1–47, *21 figs.*

RAFINESQUE-SCHMALTZ, C. S. Indice d'ittiologia siciliana, etc. (1810) 1–70, *2 pls.*

ROXAS, H. A., and C. MARTIN. A check list of Philippine fishes. Dept. Agr. Comm., Manila, Tech. Bull. 6 (1937) 1–314.

STEINDACHNER, F. Uber eine neue Scopelus und Monacanthus Art aus China. Ichthyologische Notizen (v). Sitzber, Kais. Akad. Wissensch. Wien (1) 55 (1867) 11–13, *pl. 3.*

TÅNING, A. V. Notes on scopelids from the Dana expedition, I. Vidensk. Medd. Dansk. Naturh. Foren. 94 (1932) 125–146, *figs. 1–16.*

WEBER, M. Die Fische der Siboga-Expedition. Siboga Repts. 57 (1913) xii + 1–710, *12 pls.*

WEBER, M., and L. F. DE BEAUFORT. The fishes of the Indo-Australian Archipelago. II. Malacopterygii, Myctophoidea, Ostariophysi. I. Siluroidea. Leiden (1913) xiii + 1–404, *151 figs.*

ERRATA

Page 31, line 16; makliella should read makiella.

Page 32, line 18; Oeomyza should read Oreomyza.

Page 57, line 7; Phalacrocerra should read Phalacrocera.

Page 59, lines 17, 24, 30; and page 61, lines 12 and 18; Pedica should read Pedicia.

Page 62, line 19; and page 63, line 10; Plate 2 should be Plate 1.

Page 171, line 5; Meigin should read Meigen.

Page 212, line 8; desicator should read desiccator.

Page 216, line 14; Eyrie should read Eyre.

Page 219, line 4; Figs. 3 and 4 should be Fig. 3; and Fig. 4 should be Mandaluyong type.

Page 259, Fig. 3; *N. cimicoides* should be *N. lentum*.

Page 322, line 2 from bottom; books should read book.

INDEX

[New names and new combinations are printed in *italics*.]

A

Abisiyó-, 100.
Abitsuwelas, 235.
Abulbulón, 98.
Acacia Willd., 326.
  concinna (Willd.) DC., 327.
  quisumbingii Merr., *326*.
Accipter nisus (Aves.), 315.
Actinopyga Bronn, 110, 120.
  echinites Bedf., 120.
  echinites Dom., 120.
  echinites (Jaeg.), 110, 120.
  echinites Pear., 120.
  echinites Sav.-Kent, 120.
  maculata Bedf., 122.
  mauritiana (Quoy and Gaim.), 120.
  miliaris Bell, 121.
  miliaris Dom., 121.
  miliaris Pear., 121.
  miliaris (Quoy and Gaim.), 110, 120.
  nobilis Fisher, 122.
  serratidens Pear., 110, 121.
Addát batbattug, 98.
Adixi, 77–82, 95.
Adixi-post, 82.
Adpăr, 93.
Adpăt, 92.
Aechynomene Linn., 327.
  americana Fawc. and Rend., 327.
  americana Linn., 327.
Agaaltóńán, 88.
Agabbó, 88.
Agaboluxăn, 91.
Aga-dălăn, 94.
Agamotowăn, 87.
Agansădan, 79, 94.
Aga-păn, 82.
Agaptăn, 91.
Agbabăyowăn, 88.
Agdăn, 81.
Agduhaăn, 84.
Agnádan, 78, 79, 85, 86.
Agnádan-beam, 87, 89.
Agpăr, 92.
Agpăt, 92.
Agsapanān, 87.
Agsidilān, 87.
Agsulpítān, 89.
Ăgúd, 88.
AGUILAR, RAFAEL H. The composition and physical properties of some Philippine volcanic tuffs, 209.
Álán, 77, 91.
Alásip, 84.
Aldĕ, 84.
Alĕdiń, 92, 94.
ALEJO, LEON G., *see* INTENGAN, ALEJO, CONCEPTION, YAPTINCHAY, POBRE, SALUD, and MANALO.
ALEXANDER, CHARLES P. Records and descriptions of Japanese Tipulidæ (Diptera). Part I. The crane-flies of Shikoku, I, 21; II, 141; III, 263.
Alináwań, 95.
Alipăp, 102.
Alipatpát, 103.
Alnus, 315.
Altóń, 88.
Alugbati, 232, 241.
Alyxia Brown, 334.
  angustissima, 334.
  ecostata, 335.
  linearifolia Sm., 336.
  obovatifolia Merr., 335.
  rosmarinifolia, 335.
  stenophylla Merr., 335.
Amalopina gibbera Esaki, et al., 62.
Amalopis variinervis OS., 61.
Amaranthaceæ, 325.
Amárut, 101.
Ambabákan, 91.
Amba-roofing, 91.
Amblyeleotris Blk., 349, 370.
  periophthalmus Blk., 370.
Ammăd, 79.
  Ammi Linn., 332.
  graveolens Linn., 333.
Ammŏronăn, 80.
Ampákān, 78, 81, 82, 95.
Ampalaya, 236.
Amuwăg, 95.
Anaca, 310.
Anadíxiyăn, 78.
Andameleotris Herre, 349, 367.
  palustris, 367.
  raoi, 367.
Andíliń, 92, 102.
Ańká, 97.
Anonas, 229, 242.
Ańpăt, 89.
Antestia Berg., 310.
Antestia Stål, 310.
Antestia (in part) Tang, 310.
  modificata Dist., 310.
  pulchra Tang, 310.
Aňadixiyăn, 78, 79, 80, 81.
Antocha, 23.
  satsuma Esaki, et al., 163.
  serricauda, Esaki, et al., 288.
  (Antocha) *bidigitata, 288*.
  (Antocha) bifida Alex., 163.
  (Antocha) brevinervis Alex., 189.
  (Antocha) dilatata Alex., 163, 289.

(Antocha) gracillima Alex., 289.
(Antocha) satsuma Alex., 32, 163.
(Antocha) spicata Alex., 289.
(Antocha) subconfluenta Alex., 163.
(Proantocha) serricauda Alex., 288.
Apiúm Linn., 332.
ammi auctt., 332.
leptophyllum (Pers.) F. Muell. ex Benth., 332.
Apocynaceae, 334.
Apoda Br., 110, 126.
Apodiphus amygdali Ger., 318.
Arañát, 87.
Ardisia glabra DC., 325.
japonica (Thunb.) Blm., 325.
Argiodia flavo-castanea Pear., 122.
maculata (Br.), 122.
maculata (Br.) var. thelenotæ, 122.
maculata Dom., 122.
maculata Pear, 122.
Aribâyan, 86.
Arpit, 90.
Arsapnia grandis Banks, 202.
Arsít, 90.
Ásip, 91.
Aspidochirota Gr., 110.
Assup, 87.
Asterropteryx Rup., 347, 350, 351.
ensifer Blk., 351.
everretti Boul., 351.
monacanthus Reg., 351.
sempunctatus Rup., 351.
Atáp, 82.
Atarba (Atarbodes), 24.
(Atarbodes) pallidicornis Ed., 33.
Atis, 229, 242.
Atiyóti, 89.
Atobtóbo, 77, 78.
Atobtóbo-post, 79, 82–87.
Atugán, 99.
Austrolimnophila, 23.
kirishimensis (Alex.), 163.
(Austrolimnophila) hori (Alex.), 292.
Axa-pán, 82.
Axérān, 80–85.

B

Baát, 88.
Baáw, 98.
Babákan, 91, 93.
Babatâyan, 88.
Badây, 83, 84, 85.
Bagbagsíń, 102.
Bagoong, 346, 352.
Baládag, 86, 93.
Balañá, 94.
Balanéban, 100.
Balaniban, 100.
Balansag, 89.
Baláwa, 88.
Balawán, 100.
Balawi, 99.
Balây, 77.
Balêt-trap, 103.
Balimbing, 299.
Baliwag, 101.
Ballâń, 86.
Balut, 240, 241, 242.
Báña-jars, 88.
Bañgañgay, 346, 364.
Bañsâ, 88.
Barikóko, 103.
Básag, 90,, 93.
Bási, 91.
Bassáw, 84, 89.
Batalân, 88, 91.
Batáñān, 92.
Bataw, 236, 241.
Battâl, 91.
Battúg, 98.
Bátug, 94.
Báwi, 91, 99.
Báwig, 95.
Baxákat, 88, 93, 94.
Bâydán, 99.
Belachan, 346.
Belobranchus Blk., 347, 354.
belobrancha (Cuv. and Val.), 354.
Benthosema pterota, 376.
Betula, 315.
Biang puti, 345.
Biang sunog, 358.
Bi-bít, 103.
Bi-bit-insect, 103.
Bikinigobius Herre, 182, *186*.
welanderi Herre, 182, *186*.
Binúron, 90.
Bladhia Thunb., 325.
folius serratis glabris lævibus Thunb., 324.
glabra Thunb., 324.
Boboń, 84.
Boboñán, 84.
Bohadschia argus Jaeg., 110.
marmorata Jaeg., 115.
marmorata Pear., 115.
marmorata Sel., 115.
paradoxa Pear., 115.
vitiensis Pear., 119.
Bólo, 89.
Boñráw, 78.
Boroda Herre, 348, 361.
albo-oculata Herre, 362.
expatria Herre, 362.
francoi Rox. and Abl., 362.
malua Herre, 361, 362.

Bostrichthys Dumer., 789, 347, 356.
sinensis (Lacé.), 356.
zonatus (Web.), 356.
Bóto, 79.
Bunaka Herre, 348, 362.
gyrinoides (Blk.), 362, 363.
pinguis Herre, 362, 363.
sticta Herre, 363.
Buńlún, 95.
Burok, 196.
Butis Blk., 347, 357, 358.
amboinensis Blk., 358.
butis (Ham.), 358, 361.
dasyrhynchus (Günth.), 358.
gymnopomus Blk., 358.
melanostigma Blk., 358.
prismaticus Blk., 358.

C

Caecula misolensis (Günth.), 10.
Calamiana, 181.
magnoris Herre, 181.
Calopogonium Desv., 328.
mucunoides Amsh., 328.
mucunoides Desv., 328.
Carum copticum (Linn.) Benth. and Hook. f., 332.
Casearia Jacq., 331.
paucinervia, 331.
Catacanthus incarnatus (Drury), 314.
Centrobranchus Fowl., 382.
andreæ Fowl., 383.
andreæ Fras.-Brun., 383, 387.
andreæ Gil., 383.
andreæ (Lütk.), 383.
choerocephalus Fowl., 382, 387.
gracilicaudus Gil., 383.
nigroocellatus (Günth.), 383, 387, 389.
nigro-ocellatus Fras.-Brun., 387.
Chersomenida Horv., 310.
quadrimaculata (Horv.), 310.
Chionea, 24.
Chloranthaceæ, 324.
Chlorantus Sw., 324, 325.
brachystachys Blm., 324, 325.
elatior Br. ex Sims, 325.
glaber Makino, 324.
oldhamii Solms, 325.
verticillatus Merr., 325.
Cimex rufipes Vol., 315.
taurus Fabr., 316.
taurus Stoll, 316.
Chondrocloea baselii Osterg., 127.
kefersteinii Osterg., 128.
Cladura, 23, 24.
taiwania Alex., 69, 70.
(Cladura) autumna Alex., 71.
(Cladura) decem-notata Alex., 69, 70.
(Cladura) *serrimargo, 70.*
Cnemoncosis Enderl., 41.
hilgendorfi Enderl., 41.
Compositæ, 336.
CONCEPCION, ISABEL, *see* INTENGAN, ALEJO, CONCEPCION, YAPTINCHAY, POBRE, SALUD, and MANALO.
Conosia Van der Wulp, 23, 24, 69.
irrorata Alex., 69.
irrorata Esaki, et al., 69.
irrorata Wied., 25.
irrorata (Wied.), 33, 69.
Coronogobius, 182.
striatus Herre, 182.
CRUZ, AURELIO O., *see* TUAZON and CRUZ.
Cryphaea Buch.-Ham., 324.
Ctenacroscelis, 23.
mikado Alex., 39.
mikado Esaki, et. al., 39.
mikado (Wd.), 24, 39.
Ctenophora Meig., 23, 41.
biguttata Mat., 30.
hilgendorfi Enderl., 30.
ishiharai, 39.
isshikii Mat., 30.
mikado (Wd.), 32.
nohiræ Mat., 30, 32, 39, 40, 41.
pictipennis Portsch., 41.
tricolor Loew, 41.
yezoana, 25.
Cuphea Browne, 332.
balsamona Back. and van Sloot., 332.
balsamona Cham. and Schlecht., 332.
balsamona Koeh., 332.
carthaginensis (Jacq.) Macbr., 332.
micropetala HBK., 332.
Cyclospermum leptophyllum Spr., 332.
Cylindromyia bicolor Oliv., 313.
Cylindrotoma, 23.
japonica Alex., 32.
Cylindrotominæ, 23.

D

Dabbí, 80, 93.
Dactylolabis, 23.
diluta Alex., 293.
longicauda Alex., 293.
(Dactylolabis) diluta Alex., 293.
(Dactylolabis) longicauda Alex., 293.
Dadamkán, 94, 98, 99.
Da-dapûg, 101.
Daguwây, 100.
Daimiotipula daimio Mat., 31.
Dala-dât, 89.
Dalanghita, 230, 242.
Dalipáń, 87.
Dalophis misolensis Jord. and Seale, 10.
Dalpada antennata Yang, 317.
jugatoria Bred., 317.
jugatoria China, 317.
jugatoria Dist., 317.
jugatoria Kirk., 317.
jugatoria Leth., 317.

Dalapada—Continued.
jugatoria Paiva, 317.
nigricollis Horv., 317.
obscura (Wd.), 317.
oculata Bred., 317.
oculata China, 317.
Dáñaw, 102.
Dapûg, 87.
Darák, 240, 242.
Dariñuwán, 99.
Darpít, 90.
Dasymallomyia signata Brun., 33.
Dasyscopelus Günth., 389.
pristilepis Gil., 402.
spinosus Goode and Bean, 405.
Datâg, 82, 86.
DATTA, ROBINDRA MOHON. *see* PAUL and DATTA.
Dékut, 103.
Dendrolimnophila Alex., 67.
albomanicata Alex., 67.
Deraeocoris flavilinea, 314.
Desertomenida Kirit., 310.
quadrimaculata Kirit., 310.
Desmodium Desv., 327, 328.
cajanifolium (HBK.) DC., 327.
purpureum Fawc. and Rend., 327.
purpureum (Mill.) Fawc. and Rend., 328.
spirale DC., 328.
tortuosum Sw., 327.
tortuosum (Sw.) DC., 327.
Diaphus Eigen. and Eigen., 382, 423.
chrysorhynchus Gil. and Cr., 402, 423.
theta Eigen. and Eigen., 423.
(Lamprosa) chrysorhynchus Fras.-Brun., 423.
Dicranomyia, 285.
brevivena OS., 159.
depauperata Alex., 286.
immenor OS., 159.
immodestoides Alex., 159.
immodestoides Esaki, et al., 159.
iowensis Rogers, 159.
machidai Alex., 157.
monostromia Esaki, et al., 160.
pulchra De Meij., 159.
pseudomorio Alex., 162.
Dicranoptycha, 23.
yamata Alex., 289.
Dicranota Zett., 59.
(Dicranota), 23.
(Eudicranota), 23.
(Eudicranota) dicranotoides (Alex.), 63.
(Rhaphidolabis), 23.
(Rhaphidolabis) clausa Alex., 61.
(Rhaphidolabis) consors Alex., 63, 291.
(Rhaphidolabis) flavibasis (Alex.), 292.
(Rhaphidolabis) gibbera Alex., 32, 62.
(Rhaphidolabis) *idiopyga*, 62.
(Rhaphidolabis) *persessilis*, 291.
(Rhaphidolabis) polymera Alex., 292.
Dictenidia, 22, 23.
fasciata Esaki, et al., 41.
glabrata Alex., 43.
horikawæ Mat., 30.
inaequipectinata Alex., 43.
miyatakei, 42.
pictipennis Alex., 41.
pictipennis portsch., 43.
pictipennis fasciata Coq., 32, 41, 43.
Dila anito, 100.
Dilis, 375.
Dinampíg, 78.
Dińdiń, 80.
Discobola margarita Alex., 158.
Dolichopeza, 23, 29.
(Nesopeza) albitibia (Alex.), 31, 263.
(Nesopeza) *circulans*, 143.
(Nesopeza) geniculata (Alex.), 31.
(Nesopeza) idiophallus (Alex.), 144.
(Nesopeza) tarsalis Alex., 144.
(Nesopeza) tarsalis (Alex.), 263.
(Oropeza) candidipes (Alex.), 31, 144.
(Oropeza) inomatai Alex., 144.
(Oropeza) saitamensis Alex., 144.
(Oropeza) satsuma (Alex.), 31.
DOMANTAY, JOSE S. Littoral holothurians from Zamboanga and vicinity, 109.
Dóxon, 91.
Dubá, 84.

E

Echinocarpus murex Benth., 328, 329.
sigun Blm., 328, 329.
Edessa taurus Fabr., 316.
Elaeocarpaceae, 328.
Eleotridae, 189.
Eleotris Block and Schn., 191, 347, 351, 352, 368.
balia Jord. and Seale, 352, 353.
fusca (Block and Schn.), 352.
insulindicus Blk., 352, 353.
macrocephalus Blk., 352, 353.
macrolepis Blk., 352, 353.
melanosoma Blk., 352, 353.
oxycephalus Blk., 352, 353.
Elephantomyia (Elephantomyia), 24.
(Elephantomyia) dietziana Alex., 297, 300.
(Elephantomyia) dietziana Ito, 297.
(Elephantomyia) *dietziana plumbea*, 298.
(Elephantomyia) *subterminalis*, 299.
(Elephantomyia) takachihoi Ito, 301.
(Elephantomyia) *tetracantha*, 300.
Elliptera, 23.
zipanguensis Alex., 162.
Epiphragma, 23.
(Epiphragma) evanescens Alex., 163.
(Epiphragma) subfascipennis Alex., 32, 164.

Epiphragma—Continued.
(Epiphragma) subinsignis Alex., 164.
subfascipennis Alex., 164.
subfascipennis Esaki, et al., 164.
subinsignis Alex., 32, 164.
subinsignis Esaki, et al., 164.
Ericaceae, 333.
Eriocera alboguttata Mat., 31, 68.
hilpa Esaki, et al., 68.
longifurca Alex., 69.
longifurca Esaki, et al., 69.
morosa OS., 31.
Erioptera Meig., 171.
asiatica Esaki, et al., 303.
orientalis Brun., 73.
(Acyphona) asymmetrica Alex., 72.
(Empeda), 24.
(Empeda) brumalis Alex., 302.
(Empeda) nigroapicalis Alex., 303.
(Erioptera), 24.
(Erioptera) dictenidia Alex., 73.
(Erioptera) elegantula Alex., 72.
(Erioptera) horii Alex., 303.
(Erioptera) orientalis Brun., 73.
(Hoploerioptera) *luctuosipes*, 171, *172*.
(Hoplocerioptera) *shikokuensis*, *171*, 173.
(Hoplolabis) asiatica Alex., 303.
(Psiloconopa), 24.
(Psiloconopa) asiatica Alex., 33, 303.
(Psiloconopa) asymmetrica Alex., 33, 72.
(Psiloconopa) sachalina Alex., 172.
(Psiloconopa) subareolata Alex., 172.
(Psiloconopa) yezoana Alex., 172.
(Symplecta) hybrida (Meig.), 33.
Eriopterini, 24, 69, 301.
Erthesina fullo Atk., 318.
fullo Cheo, 318.
fullo Dist., 317, 318.
fullo Dohrn, 317.
fullo Hoff., 318.
fullo Horv., 318.
fullo Kershaw, 318.
fullo Kirk., 318.
fullo Kirby, 318.
fullo Lindb., 318.
fullo Osh., 317.
fullo Stål, 317.
fullo Tang, 318.
fullo (Thunb.), 317.
guttata Fabr., 317.
mucorea Fabr., 317.
Ethulia sparganophora Linn., 336.
Eupatorium Linn., 336.
adenophorum Pope, 336.
adenophorum Spr., 336, 337.
glandulosum Deg., 337.
glandulosum HBK, 337.
glandulosum Moore, 337.
Euryaspis Dist., 309.
Euryaspis Kirk., 309.
Euryaspis Sign., 309.
Euryaspis Stål, 309.
flavescens Dist., 309.
flavescens Tang, 309.
transversalis Sign., 309.
Eviota Jenk., 192, 349, 367.
distigma Jord. and Seale, 368.
gymnocephalus Web., 368.
sealei Herre, 368.

F

Felis domestica, 223.
Fistularia impatiens Forsk., 114.
Flacourtia L'Herit., 331.
cataphracta Roxb. ex Willd., 331.
jangomas Koord. and Val., 331.
jangomas (Lour.) Raeusb., 331.
jangomas Merr., 331.
jangomas Sloot., 331.
jangomas Steud., 331.
Flacourtiaceae, 330.
Formotipula holoserica Mat., 31.
Fraxius, 315.

G

Gabi, 240, 242.
Gabi, dahon, 232.
Gagamba takei Mat., 31, 64.
Gallál, 99.
Galerucella luteola (Mull.), 313.
Galíad, 89.
Geranomyia avocetta Alex., 162.
multipunctata Alex., 287.
Gigantogobius Fowler, 348, 364.
jordani Fowler, 365.
Gliricidia sepium (Jacq.) Steud., 254.
Globericera moriokana Mat., 31.
Gnatholepis, 193, 194.
baliurus (Cuv. and Val.), 195, 196.
calliurus Jord. and Seale, 194, 196.
corlettei Herre, 195, 197.
davaoensis Seale, 197.
deltoides (Seale), 194, 195, 197.
gemmeus Herre, 195, 197.
hendersoni Herre, 195, 196.
Knight Jord. and Ever., 195, 197.
koumansi Herre, 194, 196.
mingi Herre, 194, 196.
puntangoides (Blk.), 194, 196.
scapulo-stigma Herre, 194, 196.
scapulostigma Herre, *193*.
turneri Rox. and Abl, 196.
volcanus Herre, 195, 196.
Gnophomyia OS., 24, 171.
Gobiomorphus Gill, 347, 357.
illotus Herre, 357.
sclateri (Steind.), 357.
Gomphrena Linn., 325.
celosioides Hutch., 325.
celosioides Mart., 325.
celosioides Seub., 325.
Gonichthys, 383.
Gonomyia (Idiocera) shantungensis Alex., 171.
(Idiocera) subpruinosa Alex., 33.

Gonomyia—Continued.
(Gonomyia) nansei Alex., 302.
(Lipophleps) quadrifila Alex., 302.
(Lipophleps) sauteri Alex., 302.
(Ptilostena) shantungensis Alex., 171.
Gracileotris Herre, *189*, 347, 356.
bockensis Herre, *190*, 356.
Guinamos, 346.
Guwayábano, 229, 242.
Gymnastes, 23, 24.
flavitibia (Alex.), 33.
flavitibia Esaki, et al., 71.
shirakii Alex., 33.
(Paragymnastes) flavitibia (Alex.), 71.

H

Halys mucorea Laporte, 317.
Heatomini, 23.
Helius, 23.
(Helius) brevioricornis Alex., 288.
(Helius) tenuirostris Alex., 162.
tenuirostris Alex., 32.
tenuirostris Esaki, et al., 162.
HERRE, ALBERT W. C. T. Eight additions to the Philippine fish fauna, including three new species, 9; tropical Pacific gobies with vomerine teeth, 181; the tropical Pacific Eleotridæ with vomerine teeth with descriptions of two new genera and two new species from the Marshall Islands, 189; a new species of Gnatholepis with a key to the tropical Pacific species, 193; the eleotrid gobies of the Philippines and adjacent regions, 345.
Herreolus Sm., 349, 366.
formosus Sm., 366.
philippinus Herre, 367.
Heterangæus, 23.
gloriosus kusunokii, *290*.
japonicus Alex., 61, 291.
Hevea braziliensis (HBK.) Müell.–Arg., 341.
Hexatoma (Eriocera), 23.
(Eriocera) alboguttata (Mat.), 31, 68.
(Eriocera) *cerberus*, *167*.
(Eriocera) fulvibasis Alex., 168.
(Eriocera) gifuensis Alex., 168.
(Eriocera) *imperator*, *169*, 170.
(Eriocera) kamiyai Alex., 168.
(Eriocera) kariyai Alex., 168.
(Eriocera) longifurca (Alex.), 33, 69.
(Eriocera) lygropis (Alex.), 33.
(Eriocera) moriokana (Enderl.), 33.
(Eriocera) moriokana (Mat.), 31.
(Eriocera) morosa (OS), 31.
(Eriocera) *stricklandi pallidibasis*, 68.
(Eriocera) stricklandi stricklandi (Ed.), 68.
Hexatomini, 64, 163, 292.
HOFFMAN, WILLIAM E. Third Supplement to a catalogue of Scutelleroidea, 309.
Holothuria Linn., 110.
aethiops Lam., 116.
aethiops Lud., 116.
aethiops Sel., 116.
aethiops Semp., 116.
aethiops Theel, 116.
amboinensis Semp., 111.
aphanes Lam., 114.
aphanes Sluit., 114.
argus Bell, 111.
argus Clark, 111.
argus Dom., 111.
argus (Jaeg.), 110.
argus Koehl., 111.
argus Konings., 111.
argus Lamp., 111.
argus Lud., 111.
argus Mit., 111.
argus Pann., 111.
argus Pear., 111.
argus Sav.–Kent, 111.
argus Semp., 111.
argus Sluit., 111.
argus Stud., 111.
argus Theel, 111.
argus whitel., 111.
atra Baker, 112.
atra Bell, 111.
atra Brooke, 112.
atra Clk., 111.
atra Dom., 116.
atra Ed., 112.
atra Eng., 112.
atra Erwe, 112.
atra Fisher, 112.
atra Gardn., 112.
atra Hedl., 111.
atra Herd., 112.
atra Jaeg., 110, 111, 116.
atra Jaeg. var. amboinensis Bedf., 111.
atra Jaeg. var. amboinensis Theel, 111.
atra Koeh., 111.
atra Koeh. and Van., 112.
atra Kon., 112.
atra Lamp., 111.
atra Lud., 111.
atra Mit., 112.
Atra Pann., 112.
atra Pear., 112.
atra Sav.–Kent, 111.
atra Sel., 111.
atra Semp., 111.
atra Sluit., 111.
atra Step., et al., 112.
atra Stud., 111.
atra Theel, 111.
atra Vol., 112.
atra Whitel., 111.
bivittata Mit., 110, 112.
botellus Sav.–Kent, 114.
botellus Sel., 114.

Holothuria—Continued.
botellus Semp., 114.
brandii Sel., 115.
cadelli Bell, 117.
clemens Lud., 119.
clemens Mit., 119.
clemens Theel, 119.
curiosa Lamp., 113.
curiosa Lud., 110, 113.
curiosa Pear., 113.
curiosa Sluit., 113.
curiosa Theel, 113.
forsakali Chiaje, 118.
fulva Quoy and Gaim., 114.
fusco-cinerea Clk., 113.
fusco-cinerea Dom., 113.
fusco-cinerea Jaeg., 113.
fusco-cinerea Lud., 113.
fusco-cinerea Lud. and Bart., 113.
fusco-cinerea Mort., 113.
fusco-cinerea Sav.-Kent, 113.
fusco-cinerea Theel, 113.
gallensis Pear., 117.
impatiens Bed., 114.
impatiens Bell., 114.
impatiens Bord., 114.
impatiens Clk., 114.
impatiens Deich., 114.
impatiens Dom., 114.
impatiens Erwe, 114.
impatiens Fish., 114.
impatiens (Forskål), 110, 114.
impatiens Gray, 114.
impatiens Haacke, 114.
impatiens Her., 114.
impatiens Koehl., 114.
impatiens Koehl. and Van., 114.
impatiens Kon., 114.
impatiens Lamp., 114.
impatiens Lud., 114.
impatiens Mar., 114.
impatiens Mort., 114.
impatiens OS., 114.
impatiens Pann., 114.
impatiens Pear., 114.
impatiens Risso., 114.
impatiens Sel., 114.
impatiens Sav.-Kent, 114.
impatiens Schmidt, 114.
impatiens Semp., 114.
impatiens Sluit., 114.
impatiens Step., 114.
kollikeri Lud., 119.
kollikeri Lud., and Bart., 119.
kollikeri Semp., 119.
kollikeri Theel, 119.
leopardus Sav.-Kent, 111.
lineolata Brandt, 121.
lineolata Quoy and Gaim., 121.
lineolata Sel., 121.
maculata Brandt, 122.
maculata Cham. and Eysen., 126.
maculata Sel., 122.
Holothuria—Continued.
maculata Semp., 122.
marmorata Bell, 115.
marmorata Clk., 115.
marmorata Jaeg., 110.
marmorata (Jaeg.), 115.
marmorata Kon., 115.
marmorata Lamp., 115.
marmorata Lud., 115.
marmorata Lud., and Bart., 115.
marmorata Mit., 115.
marmorata Pear., 115.
marmorata Sav.-Kent, 115.
marmorata Sel., 115.
marmorata Semp., 115
marmorata Sluit., 115.
marmorata Theel, 115
miliaris Quoy and Gai. 120.
miliaris Sel., 120.
oceanica Less., 126.
paradoxa Fish., 115.
paradoxa Lam., 115.
paradoxa Sel., 110, 115.
paradoxa Semp., 115.
paradoxa Theel, 115.
pulla Bell, 116.
pulla Pann., 116.
pulla Pear., 116.
pulla Sel., 110, 115.
pulla Semp., 116.
pulla Theel, 116.
radackensis Cham., and Eysen., 111.
sæcularis Bell, 110, 118.
sæcularis Bell var. *forskali*, *110*, 118.
sanguinolenta Bell, 111.
sanguinolenta Dom., 111.
scabra Clk., 117.
scabra Dom., 117.
scabra, Haac., 117.
scabra Jaeg., 110, 117.
scabra Koehl., 117.
scabra Kon., 117.
scabra Linn., 117.
scabra Lud., 117.
scabra Mit., 117.
scabra Pear., 117.
scabra Schm., 117.
scabra Sel., 117.
scabra Semp., 117.
scabra Theel, 117.
scabra Van., 117.
similis Lamp., 119.
similis Semp., 119.
similis Theel, 119.
tenuissima Koehl., 119.
tenuissima Koehl., and Van., 119.
tenuissima Lamp., 119.
tenuissima Lud., 119.
tenuissima Pear., 119.
tenuissima Sluit., 119.
tenuissima Semp., 119.
tenuissima Theel, 119.
tigris Sel., 117.

Holothuria—Continued.
ualensis Sel., 115.
utrimquestigmosa Haac., 115.
vitiensis Dom., 119.
vitiensis Fish., 119.
vitiensis Koehl., 119.
vitiensis Kon., 119.
vitiensis Lamp., 119.
vitiensis Lud., 119.
vitiensis Mit., 119.
vitiensis Pear., 119.
vitiensis Sav.-Kent, 119.
vitiensis Semp., 119, 110.
vitiensis Sluit., 119.
vitiensis Theel, 119.
(Actinopyga) echinites Pann., 120.
(Actinopyga) formosa (Sel.) Pann., 126.
(Actinopyga) serratidens Pann., 121.
(Bohadschia) bivittata Pann., 112.
(Bohadschia) mamorata Pann., 115.
(Bohadschia) paradoxa Pann., 115.
(Bohadschia) vitiensis Pann., 119.
(Holothuria) curiosa Pann., 113.
(Holothuria) sæcularis Pann., 118.
(Microthele) nobilis Pann., 122.
(Thelenota) Ananas Br., 126.
Holothuriidæ Lud., 110.
Holothuriinæ Lud., 110.
Hoplistodera, 311.
rubrofasciatus Tang, 312.
Hoploerioptera, 171.
Hydnocarpus Gaertn., 330.
palawanensis, 330.
subfalcata Merr., 330, 331.
unonifolia Elm., 330.
Hygophum Tån., 382, 418.
(Tåning) Bol., 382.
reinhardti Fras.-Brun., 419.
reinhardtii (Lutk.), 418, 422.
Hypseleotris Gill, 347, 354.
agilis Herre, 354, 355.
bipartita Herre, 355.
cyprinoides, 355.
guntheri (Blk.), 354, 355.
leuciscus Blk., 354, 355.
modestus (Blk.), 355.
pangel Herre, 355.
quisumbingi Rox., and Abl., 355.
tænionotopterus (Blk.), 355.

I

Idioglochina Alex., 161.
Inababsóń, 101.
Inapostol, 16.
Inapúxăn, 96, 97, 99, 100.
Insupán, 87.
INTENGAN, CARMEN Ll., LEON G. ALEJO, ISABEL CONCEPTION, CESAR YAPTINCHAY, VICTORIA L. POBRE, ROSITA D. SALUD, and JOSEFINA D. MANALO. Composition of Philippine foods, I, 227.
Intonsogobius, 182.
kuderi Herre, 182.
Inulnåy, 99.
Isocapnia Banks, "02.
abbreviata Fris., 202.
crinita (Need. and Claass.), 202.
grandis (Banks), 202.
Integra Han., 202.
japonica, 202, 203.
Irāt, 84.

K

Kalabasa, 232, 236, 241.
Kalabaw var., 230.
Kalamansi, 229, 242.
Kamatis, 236.
Kamokamotihan, 232, 241.
Kamote, 238, 242.
Kamumbon, 196.
Kangkong, 232, 241, 242.
Kapónān, 101.
Karót, 238.
Kasixidān, 78.
Katanda, 233, 241.
Katandang aso, 241.
Kataratara, 332.
Kaupichthys diodontus Schul., 9.
Kinoblón, 99.
Kintsay, 233, 241.
KOHNO, MRS. MITSUKO. New species of Capnidæ (Plecoptera) from Japan, 199.
Koliplawer, 238, 242.
Kópán, 100.
Kulaxáw, 102.
Kumí, 101.
Kutsarita, 233, 241.
Kutsay, 233.

L

Labág-bird, 95, 98.
Labanos, 239.
Lalakån, 93.
Lalamdáwan, 80.
Lampanyctus niger, 376.
Lamug, 353.
Lañpá, 89.
Lansones, 229.
Lappó, 91.
Lasí, 78, 95.
Latundan, 238.
Láwañ, 95.
Leguminosæ, 326.
Lelia decempunctata Esaki, et al., 312.
decempunctata (Mot.), 312.
decempunctata Osh., 312.
decempunctata Tang, 312.
octopunctata Dist., 313.
octopunctata Kirk., 313.
octopunctatus (Dallas), 312.
octopunctatus Tang, 313.
porrigens Wal., 312.
10-punctata Kirt., 312.
Limonis anthracina (Alex.), 285.

Letsugas, 241, 242.
Líbań, 94.
Libnotes, 157.
undulatus Mat., 31, 158.
Liliaceæ, 323.
Lillipút, 100.
Limang sugat, 233.
Limnobia, 24.
amatrix Alex., 158.
anthracina Alex., 156.
longipennis Schum., 159.
pusilla Lacks., 157.
satsuma Wd., 67.
sciophila OS., 157.
subnubeculosa Alex., 157.
tanakai Alex., 284.
variinervis Zett., 61.
Limnophila (Adelphomyia), 22, 23.
auribasis Esaki, et al., 164.
crux Doles., 69.
inconcussa Alex., 164.
japonica Esaki, et al., 149, 165.
kirisimensis Alex., 163.
satsuma Esaki, et al., 24, 64.
satsumicola Alex., 296.
subnemoralis Alex., 167.
substituta Wal., 69.
(Adelphomyia) *acicularis, 293.*
(Adelphomyia) brevirama Alex., 296.
(Adelphomyia) caesiella Alex., 296.
(Adelphomyia) flavella Alex., 296.
(Adelphomyia) pilifer Alex., 295.
(Dendrolimnophila) *shikokuensis,* 66.
(Dicranophragma), 23.
(Dicranophragma) *microspila, 165.*
(Dicnanophragma) taiwanensis Alex., 166.
(Dicranophragma) upsilon Alex., 167.
(Elæophila), 23.
(Elæophila) formosa Alex., 33.
(Elæophila) dietziana Alex., 167.
(Elæophila) subaprilina Alex., 167.
(Ephelia) dietziana Alex., 167.
(Ephelia) subaprilina Alex., 167.
(Eulimnophila) tokionis Alex., 167.
(Eutonia), 23.
(Eutonia) satsuma (Wd.) 31, 32, 64.
(Lasiomastix) breviramus Alex., 296.
(Limnophila), 23.
(Lmnophila) japonica Alex., 32, 165.
(Phylidorea), 23.
(Poecilostola) satsuma Alex., 64.
(Prionolabis), 23.
(Prionolabis) acutistylus Alex., 296.
(Prionolabis) auribasis Alex., 33, 164.
(Prionolabis) inermis Alex., 66.
(Prionolabis) lipineura Alex., 66.
(Prionolabis) lipophleps Alex., 65, 66.
(Prionolabis) nigrofemorata Alex., 297.
(Prionolabis) odai Alex., 165.
(Prionolabis) *recurvans, 64,* 66.
Limnophila—Continued.
(prionolabis serridentata Alex., 66.
(Prinolabis) *shikokuana, 65,* 66.
(Prionolabis) submunda Alex., 165.
(Prionolabis) *uncinata, 296.*
(Tricholimnophila) cæsiella Alex., 296.
Limnorimarga, 287.
Limonia anthracina (Alex.), 285.
limonioides (Alex.), 287.
aperta Wahl., 159.
basispina Alex., 282.
biceps Alex., 156.
divaricata Alex., 158.
fusciceps Alex., 156.
nubeculosa Meig., 157.
patens Lunds., 159.
plutonis Alex., 157.
sciophila, 157.
signipennis Coq., 160.
subnubeculosa Esaki, et al., 157.
tanaki Esaki, et al., 284.
tristina Alex., 285.
(Dicranomyia), 23.
(Dicranomyia) caledonica Ed., 161.
(Dicranomyia) depauperata (Alex.), 286.
(dicranomyia) fullowayi Alex., 161, 162.
(Dicranomyia) immodestoides Alex., 32, 159.
(Dicranomyia) iowansis Alex., 159.
(Dicranomyia) longipennis Alex., 159.
(Dicranomyia) longipennis (Schum.), 159.
(Dicranomyia) marmorata (OS.), 160.
(Dicranomyia) mesosternata Alex., 32.
(Dicranomyia) monostromia Tok., 160.
(Dicranomyia) *nankaidoensis,* 160.
(Dicranomyia) poli Alex., 161, 162.
(Dicranomyia) pseudomorio Alex., 162.
(Dicranomyia) shinanoensis Alex., 286.
(Dicranomyia) takahasii (Alex.), 32.
(Dicranomyia) takeuchii (Alex.), 32, 162.
(Discobola), 23.
(Discobola) margarita Alex., 158.
(Euglochina), 23.
(Geranomyia), 23.
(Geranomyia) avocetta (Alex.), 162.
(Geronomyia) gifuensis (Alex.), 286.
(Geranomyia) multipunctata (Alex.), 287.
(Libnotes), 23.
(Libnotes) amatrix Alex., 158.
(Libnotes) divaricata Alex., 158.
(Libnotes) nigriceps (Van der Wulp), 32.
(Libnotes) nohiræ Alex., 32.
(Libnotes) undulata (Mat.), 31, 158.
(Limnonia) basispina Alex., 282.
(Limonia) angustistria Alex., 32.
(Limonia) anthracina (Alex.), 156.
(Limonia) fusciceps Alex., 156.
(Limonia) esaki (Alex.), 282.
(Limonia) euphileta Alex., 156.

Limonia—Continued.
(Limonia) inelegans (Alex.), 284.
(Limonia) machidai Alex., 157.
(Limonia) machidai (Alex.), 157, 284.
(Limonia) monacantha Alex., 283.
(Limonia) neonebulosa Alex., 32.
(Limonia) nubeculosa Ed., 157.
(Limonia) nubeculosa Meig., 32, 157.
(Limonia) *omogœnsis*, 283.
(Limonia) plutones Alex., 157.
(Limonia) subnubeculosa Alex., 32, 157.
(Limonia) tanakai Alex., 32.
(Limonia) tanaki (Alex.), 284.
(Limonia) tristina Alex., 285.
(Metalimnobia) annulus truncata Alex., 32.
(Peripheroptera) arcuata Alex., 162.
(Rhipidia) maculata lecontei Alex., 158.
(Rhipidia) lacontei Alex., 158.
(Rhipidia(lecontei (Alex.), 32.
(Rhipidia) maculata Ed., 158.
(Rhipidia) pulchra (De Meijere), 159.
(Thrypticomyia), 23.
(Thrypticomyia) unisetosa Alex., 162.
Limoniinæ, 23, 156, 282.
Limoniini, 23, 136, 282.
Linóń, 77.
Liogma, 23.
fuscipennis Alex., 55, 56.
kuwanai Alex., 56.
serraticornis Alex., 32, 55.
serraticornis Esaki, et al., 55, 56.
Lipsothrix, 24.
leucopeza, 170.
taiwanica Alex., 170.
yamamotana omogœnsis, *301*.
Lizettea Herre, 348, 360.
pelewensis Herre, 360.
Longurio pulverosa Alex., 38.
pulverosa Esaki, et al., 38.
pulverosa (Mat.), 31, 32, 38, 39.
rubriceps Ed., 32.
(Longurio) fulvus Ed., 38.
(Longurio) pulverosa (Mat.), 31, 38, 39.
(Longurio) *yanoi*, *38*.
Lu-mó, 95.
Luzoneleotris Herre, 349, 368.
nasugbua Herre, 368.
Lythraceæ, 332.
Lythrum carthaginensis Jacq., 332.

M

Mabalaxúbug, 98.
Mabárut, 101.
Mabuńlúnān, 95.
Macgregoromyia *shikokuana*, *264*.
Macrodontogobius, 182.
wilburi Herre, 182.
Magbatáy, 88.
Magbâyo, 88.
Magpa-dá-, 94.
Magpakkáw, 96.
Magpatalíp, 96.
Magsáñal, 95.
Magsilpút, 98.
Magtarât, 77.
Magtarikâyo, 94.
Maíñal, 101.
Malunggay, 234, 241, 242.
MANALO, JOSEFINA D., *see* INTENGAN, ALEJO, CONCEPTION, YAPTINCHAY, POBRE, SALUD, and MANALO.
Mangarinus, 182.
waterousi Herre, 182.
Manggá, 242.
Manggá, kalabaw, 229.
Mani, 239.
Manírām, 96.
Mańmańkit, 96.
Mars, 183.
cæruleo-maculatue Herre, 183, 187.
heydeni Herre, 183.
strigilliceps Jord., 183, 187.
Maxalaláw, 95.
Maxalud-úd, 94.
Maxanito, 96.
Maxumë-, 96.
Melon, 242.
Melon, kastila, 230.
Menida quadrimaculata Hord., 310.
quadrimaculata Osh., 310.
quadrimaculata Tang, 310.
MERRILL, E. D., and EDUARDO QUISUMBING. New Philippine plants, II, 323.
Mesodictenidia macraeformis Mat., 43.
Microthele Br., 110, 122.
æthiops Br., 116.
nobilis (Sel.), 110, 122.
Mimosa Linn., 327.
invisa Benth., 327.
invisa Mart., 327.
Mindorogobius, 182.
lopezi Herre, 182.
Miscanthus sinensis Andr., 84.
Molophilus, 24.
gracilis, 73, 304.
pegasus Alex., 73.
(Molophilus) albohalteratus Alex., 173.
(Molophilus) *daimo*, 173.
(Molophilus) efferox Alex., 177.
(Molophilus) ferox Alex., 305.
(Molophilus) gracilis, 176, 177.
(Molophilus) *ishizuchianus*, *304*.
(Molophilus) *itoanus*, *73*.
(Molophilus) *iyoanus*, *175*, 176.
(Molophilus) *nesioticus*, *176*.
(Molophilus) *nocticolor*, 175, *177*.
(Molophilus) pegasus Alex., 73, 176.
(Molophilus) polycanthus Alex., 74, 177.
(Molophilus) takaoensis Alex., 175.
(Molophilus) trifilatus Alex., 305.
Moringua macrochir Blk., 11.
raitaborua Günth., 11.

Morus alba Linn., 254.
Mulleria echinites Er., 120.
echinites Jaeg., 120.
echinites Lamp., 120.
echinites Lud., 120.
echinites Mit., 120.
echinites Pear., 120.
echinites Sel., 120.
echinites Semp., 120.
echinites Sluit., 120.
echinites Theel, 120.
echinites White., 120.
hadra Lamp., 122.
hadra Sel., 122.
hadra Theel, 122.
maculata Er., 122.
maculata Lamp., 122.
maculata Lud., 122.
maculata Mit., 122.
miliaris Br., 120.
miliaris Haac., 120.
miliaris Koehl. and Van., 120.
miliaris Lamp., 120.
millaris Lud., 120.
miliaris Pear., 120.
miliaris Semp., 120.
miliaris Sluit., 120.
miliaris Theel, 120.
nobilis Sel., 122.
plebeja Sel., 121.
Mulug, 353.
Muraenichthys acutirostris Web., and Beauf., 9.
Mustasa, 241, 233.
Myctophidae Gill, 382.
Myctophum Rafine., 389.
andreae Parr, 383.
coccoi andreae Brau., 383.
asperum Ric., 389.
aurolaternatum Gar., 390.
aurolaternatum aurolaternatum Fowl., 391, 394.
aurolaternatum gracilior Fowl., 391.
benoiti reinhardti Brau., 418.
benoiti reinhardti Web., 418.
benoiti reinhardti Web. and de Beauf., 418.
brachygnathos (Blk.), 390, 399, 405.
evermanni Beebe and Vander Pyl, 413.
evermanni Gil., 390, 413, 417, 418.
evermanni Parr, 413.
evermanni Weber, 413.
fibulatum Gil. and Cr., 423.
gilberti, 376.
Lychnobium Blin, 390, 410, 413.
margaritatum Gil., 390, 395, 398.
nigrum, 376.
pristilepis Gil., 402.
pristilepis (Gil. and Cr.), 390, 402.
pristilepis Parr., 402.
pristilepis Web., 402.
pristilepis Web. and de Beauf., 402, 413.
pterotum, 376.
punctatum Rafines., 389.
reinhardti Beebe and Vander Pyl. 419.
reinhardtii (Goode and Bean), 418.
reinhardti Parr, 419.
spinosum (Steind.), 390, 405.
spinosum Web., 405, 408, 410, 412, 413.
(Diaphus) chrysorhynchum Brau., 423.
(Hygophum) reinhardtii Bol., 419.
(Myctophum andreae Brau., 383.
(Myctophum) aurolaternatum Brau., 390.
(Myctophum) aurolaternatum Fras.-Brun., 390.
Myctophum—Continued.
(Myctophum) benoiti reinhardtii Brau., 418.
(Myctophum) brachygnathos Fras.-Brun., 399.
(Myctophum) choerocephalus Brau., 387.
(Myctophum) coccoi f. regularis Brau., 387.
(Myctophum) evermanni Brau., 414.
(Myctophum) lychnobium Fras.-Brun., 410.
(Myctophum) pristilepis Brau., 402.
(Myctophum) spinosum Brau., 405.
(nigro-ocellatum Parr, 383, 387.
(Scopelus) evermanni Fras.-Brunn., 414.
Myersina, 183.
Myersina macrostoma Herre, 183.
Myzomyia funesta, 56.

N

Nagbăyúgăn, 101.
Nanobrachium nigrum, 376.
Nasńassăr, 90.
Nasiterma variinervis Well., 61.
Neckia Korth., 329.
Neckia grandiflora Ridl., 330.
ovalifolia Capit., 330.
philippinensis, 329.
serrata Korth., 330.
Nemateleotris Fowl., 349, 371.
magnificus Fowl., 371.
Nemocapnia Banks, 199.
Nemocapnia Fris., 199.
Nemocapnia Hans., 199.
Nemocapnia carolina Banks, 199, 200, 201.
japonica, 199, 200, 201.
Nephrotoma, 23.
akitæ Alex., 266, 267.
atrolatera Alex., 147.
bifusca Alex., 265.
cornicina Esaki, et al., 145.
cornicina (Linn.), 32, 145.
daisensis Alex., 145.
electripennis, 146.
esakii Alex., 147.
flavonota (Alex.), 148.
hokkaidensis Alex., 148.
ipoensis, 226.
makiella (Mat.), 31.

Nephrotoma—Continued.
minuticornis (Alex.), 32.
minuticornis Alex., 147, 272.
minuticornis Alex., 268.
minuticornis Esaki, et al., 268.
minuticornis Shiraki, 268.
pullata (Alex.), 148.
sinensis Alex., 149.
sinensis Esaki, et al., 149.
sinensis (Ed.), 32, 149.
serristyla Alex., 146.
stygia Alex., 32.
subpratensis Alex., 149.
takeuchii Alex., 32.
virgata (Coq.), 29, 32, 149.
virgata Masaki, 149.
Nesopeza albitibia Alex., 263.
albitibia Esaki, et al., 263.
idiophallus Alex., 144.
Nezara subgen. Piezodorus Stål, 311.
Nigrina brachystachys Nak., 324.
Nioiwase, 16.
Nipa fructicans Wurmb., 89.
Nipponomyia, 23.
trispinosa Alex., 32.
Nippotipula nubifera Coq., 31.
nubifera Mat., 44.
Nosodendron californicum Horn., 253.
lentum, *254*, 259.
fasciculare Oliv., 253, 254, 259.
unicolor Say, 253, 159, 260.

O

Ochnaceae, 329.
Odonteleotris Gill., 348, 360.
Odonteleotris canina Blk., 360.
Odontobutis Blk., 348, 359.
obscura (Schleg.), 359.
OEHME-LEONHARDT, BRIGITTE G. A new Philippine species of Nosodendron, 253.
Okra, 236.
Opheodesoma Fisher, 110.
spectabilis Fish. var. puerto-galerae Dom., 110, 127.
Ophichthys misolensis Günth., 10.
Ophiocara Gill, 348, 363.
aporos Blk., 346, 363, 364.
porocephala (Cuv. and Val.), 363, 364.
Oreomyza Pokor., 280, 282.
Orimarga (Lminorimarga) limonioides Alex., 287.
Orimarga (Orimarga) yakushimana Alex., 287.
Orimarga yakushimana Alex., 287.
Ormá, 89.
Ormosia, 24.
atripes Alex., 173.
cinctifer Alex., 303.
confluenta Alex., 71.
laevistyla Alex., 303.
nantaisana Alex., 304.
Ormosia—Continued.
similis, 71.
takeuchii Alex., 33, 72.
takeuchii Esaki, et al., 72.
tokionis Alex., 33, 304.
tokionis Esaki, et al., 304.
(Ormosia) atripes Alex., 173.
(Ormosia) laevistyla Alex., 303.
(Ormosia) *remissa*, *71*.
(Ormosia) takeuchii Alex., 72.
(Scleroprocta) cinctifer Alex., 303.
Oropeza, 23.
Orthostomus Kner, 350, 368, 373.
amblyopinus Kner, 373.
Oryza coarctata, 15.
sativa, 15, 16, 17.
sativa var. plena, 16.
Otantestia Berg., 310.
Otantestia Bred., 310.
Otantestia Kirk., 310.
heterospila Kirk., 310.
heterospila (Wal.), 310.
Oxyleotris fimbriatus (Web.), 366.
heterodon Web., 366.
marmorata (Blk.), 365.
Oxymetopon Blk., 350, 373.
typus Blk., 373.
Oxyeleotris Blk., 349, 365.
urophthalmoides (Blk.), 366.
urophthalmus (Blk.), 365.
urophthalmus var. novae guineæ Koum., 365.

P

Pabbág, 79.
Pa-bít, 80.
Pachyrhina cornicina Brol., 145.
cornicina Gzizzek, 145.
cornicina Riedel, 145.
flavonota Alex., 148.
makiella Mat., 31.
pullata Alex., 148.
serricornis Brune., 149.
sinensis Ed., 149.
virgata Alex., 149.
Padi-di-, 101.
Pad-óń, 87.
Padúrot, 79.
Pa-gêr, 84.
Paglańkân, 96.
Pahutan, 230.
Pákad, 89.
Pakêbây, 89.
Pako, 241, 234.
Pakuwan, 230.
Pakuwan, buto, 239.
Palán, 84.
Palańípáń, 101.
Palasân, 87.
Pálây, 79.
Pales cornicina Mann., 145.
Paloa Herre, 348, 360.
polylepis Herre, 360, 361.
villadolidi Rox. and Abl., 360, 361.

Pallidogobius Herre, 182, *184*.
Palońsawăy, 78.
Palowon, 346.
Pálut, 92, 93, 94.
Pallidogobius *rigilius* Herre, 182, *185*.
Páñal, 93.
Panarānān, 99.
Papaya, 230.
Pañtúd, 82.
Paradelphomyia, 23.
Paratāg, 87.
Paratropeza flavitibia Alex., 71.
Parbó, 91, 93.
Parviparma Herre, 350, 371.
straminea Herre, 371.
Pasañgít, 88.
Pásit, 79.
Patalkĕb, 93.
Patalkúb, 93.
Patani, 236, 240.
Patapāya, 95.
Patatas, 239.
Patola, 237.
Patúna, 82.
PAUL, ASOKA KUMAR, and ROBINDRA MOHON DATTA. On the morphology and development of the female gametophyte in Oryza coarctata Roxb., 15.
Páwat, 79.
Páwiñ, 92.
Páxa, 87.
Páxa-shelf, 98, 101.
Payoñ-o, 84.
Pedicia, 59.
(Nasiternella) variinervis hokkaidensis Alex., 61.
(Nasiternella) hokkaidensis Alex., 61.
(Pedicia), 23.
(Pedicia) daimio (Mat.), 32.
(Pedicia) grandior (Alex., 58, 59.
(Pedicia) gaudens (Alex.), 58.
(Tricyphoma), 23.
(Tricyphona confluens (Alex.), 59.
(Tricyphona) *fimfriatula*, 59.
(Tricyphoma) grandior Alex., 32.
(Tricyphona) insulana (Alex.), 59.
(Tricyphona) kirishimensis Alex., 59.
(Tricyphona) optabilis (Alex.), 290.
(Tricyphona) pectinata (Alex.), 59.
(Tricyphona) patens (Alex.), 59.
(Tricyphona) seticauda (Alex.), 61.
(Tricyphona) yakushimana (Alex.), 290.
Pediciini, 290.
Pedicini, 23.
Peliosanthes Andr., 323.
mantegazziana Pamp., 323.
teeta Andr., 324.
teeta Andr. var. angustifolia Ridl., 323.
teeta Andr. var. mantegaziana Pamp., 323.
teeta Redouté, 324.
Peliosanthes—Continued.
teeta sensu Ridl., 323.
teeta Sims, 324.
Pentatoma armandi (Fal.), 314.
armandi Yang, 314.
leliiformis, 313.
metallifera Kirit., 314.
metallifera Kirk., 314.
metallifera (Mot.), 314.
metallifera Osh., 314.
pulchra Dal, 310.
pulchra Dohrn, 310.
pulchra Leith., 310.
rufipes Bunn., 315.
rufipes China, 315.
rufipes de Seabra, 315.
rufipes Frey-Gessn., 314.
rufipes Gaede, 314.
rufipes Goug., 314.
rufipes Esaki, et al., 315.
rufipes Har., 315.
rufipes Kirk., 315.
rufipes Korm., 315.
rufipes Linb., 315.
rufipes (Linn.), 314.
rufipes Mil., 315.
rufipes Mor., 315.
rufipes Osh., 315.
rufipes Rat., 314.
rufipes Reut., 315.
rufipes Schm., 315.
rufipes Tang, 315.
Pepino, 237.
Petsay, 234, 240, 241, 242.
Phalacrocera mikado Alex., 57.
Phaseolus vulgaris, 312.
Phyllolabis OS., 23.
Physaloptera canis Moen., 221, 222.
felidis Ack., 224.
malayensis Ortl., 221, 222, 223.
pacitae Tub., 223.
praeputialis v. Linst., 221, 222, 223.
pseudopraeputialis, *221*, 223, 224.
rara Hall, 224.
Piezodorus Banks, 311.
Piezodorus Barb., 311.
Piezodorus China, 311.
Piezodorus Dist., 311.
Piezodorus Doug., 311.
Piezodorus Doug. and Scott, 311.
Piezodorus Fieber, 310.
Piezodorus Kirk., 311.
Piezodorus Mul., 311.
Piezodorus Osh., 311.
Piezodorus Puton, 311.
Piezodorus Stål, 311.
Piezodorus Van Duz., 311.
degeeri Fieb., 310, 311.
hybneri Cheo, 312.
hybneri Li, 312.
hybneri Van Duz., 312.
incarnatus Ger., 311.
lituratus (Fabr.), 311.

Piezodorus—Continued.
rubrofasciatus Berg., 311.
rubrofasciatus Bred., 311.
rubrofasciatus Chees., 311.
rubrofasciatus Cheo, 312.
rubrofasciatus China, 311, 312.
rubrofasciatus Dist., 311.
rubrofasciatus Esaki, et al., 312.
rubrofasciatus (Fabr.), 311.
rubrofasciatus Hoff., 312.
rubrofasciatus Ish., 312.
rubrafasciatus Jean., 311.
rubrofasciatus Kirk., 311.
rubrofasciatus Osh., 311.
rubrofasciatus Tak., 312.
Pilaria, 23.
melanota Alex., 167.
tokionis melanota Alex., 167.
Pílay, 99.
Pilay-spirits, 98, 101.
Pildap, 96.
Pimpinella leptophylla Pers., 332.
Piña, 230.
Pina, nata de, 230.
Pinipig, 240, 242.
Pisó, 89, 93.
Pisoodonophis *copelandii* Herre, *10*.
micropterus Blk., 11.
Placosternum dama (Fabr.), 315.
taurus Amy. and Serv., 316.
taurus Atkin., 316.
taurus Dal., 316.
taurus Dist., 316.
taurus Dohrn, 316.
taurus (Fabr.), 316.
taurus Her.-Schaef., 316.
taurus Kirby, 316.
taurus Kirk., 316.
taurus Leth., 316.
taurus Stål, 316.
taurus Tang, 316.
taurus Van Duz., 316.
taurus Wal., 316.
tumidum, 316.
Platytipula moiwana Mat., 31.
Plesiops altivelis Steind., 11.
POBRE, VICTORIA L., *see* INTENGAN, ALEJO, CONCEPCION, YAPTINCHAY, POBRE, SALUD, and MANALO.
Pogoneleotris Blk., 348, 361.
heterolepis (Gunth.), 361.
microps Web., 361.
Pogonoculius Fowl., 350, 372.
zebra Fowl., 372.
Pokól, 95.
Polyangaeus japonicus Alex., 61.
Polyplectana Clk., 110, 128.
kerfersteinii Clk., 128.
kefersteinii Dom., 128.
kefersteinii (Sel.), 110, 128.
Populus, 315.
Potáran, 101.
Prionobutus Blk., 347, 358.
dasyrhynchus Gunth., 359.
koilomatodon Blk., 359.
Prionochilus decempunctatus Stål, 312.
Pselliophora, 23, 41.
bifascipennis Brun., 30.
hoppo Mat., 30.
isshikii (Mat.), 31.
Pseudolimnophila, 23.
horii Alex., 292.
inconcussa (Alex.), 32.
inconcussa Alex., 164.
inconcussa Esaki, et al., 164.
Pterculiops, 368.
Pterelectris Gill, 350, 367.
dispersus Herre, 372.
evides Jord. and Hubbs, 372.
heteroptera Blk., 372.
microlepis (Blk.) Gill, 372.
Pteroculiops Fowl., 349, 370.
guttatus Fowl., 370.
Ptychoptera scutellaris Mat., 31.
Pulot, 240.
Puxáro, 87.

Q

Quercus, 315.
QUISUMBING, EDUARDO, *see* MERRILL and QUISUMBING.

R

Radát, 90.
Rárat, 84.
Remolatsa, 239.
Renardia decempunctatus Jak., 312.
Repolyo, 234.
Rhabdomastix, 24.
(Sacandaga) japonica Alex., 302.
Rhamphidia brevioricornis Alex., 388.
Rhapidolabina dicranotoides Alex., 63.
gibbera Alex., 62.
consors Alex., 291.
Rhaphigaster auranthus, 314.
8-punctatus Dal., 312.
gresea Coub., 313.
grisea Duf., 313.
griseus Leth., 313.
griseus Mul., 313.
nebulosa Bose, 314.
nebulosa de Saab., 313.
nebulosa Kirk., 313.
nebulosa Lindb., 314.
nebulosa Osh., 313.
nebulosa (Poda), 313.
nebulosa Tang, 314.
nebulosa Ull., 314.
Ribayan, 86.
Rikoddőń, 99.
Rhinoscopelus andreae Goode and Bean, 383.
Rhipidia maculata Esaki, et al., 158.
maculata Meig., 158.
pulchra de Meijere, 159.

pulchra septentrionis Alex., 159.
pulchra septentrionis Esaki, et al., 159.
Rhododendron Linn., 333.
acrophillum, 333.
copelandii Merr., 333, 334.
edanoii, 333.
whiteheadii Rend., 333.
Rhynchocoris plagiatus (Wal.), 314.
Rimas, 237.
Rogadius pristiger, 13.
Roumea jangomas Spreng., 331.

S

Saba var., 238.
Saddán, 101.
Sâg-ám-sacrifices, 99.
Saging, puso, 238.
Saintlegeria Cordem., 324.
gracilis Cordem., 324.
Sakit, 99.
Sakkár, 81, 82, 83.
Saldá, 81.
Sali-ńiñât, 87.
Salix, 315.
SALUD ROSITA D., *see* INTENGAN, ALEJO, CONCEPCION, YAPTINCHAY, POBRE, SALUD, and MANALO.
Saluyot, 241, 242.
Sanigmuyáw, 100.
Santâxân, 82.
Sarcandra Gardn., 324.
glabra Swamy and Bailey, 324.
glabra (Thumb.) Nakai, 324.
hainanensis Swamy and Bail., 325.
SARENAS, ARTEMIO M. A revision of the Philippine Myctophidae, 375.
Sawsáw-bird, 102.
Saxudsúd, 92.
Sây-ám, 96.
Sayote, 234, 237.
Schizostachyum mucronatum Mack., 89.
Scopelidæ, Owen, 382.
Scopelini Mull., 382.
Scopelus Cuv., 389.
brachygnathos Blk., 399.
nigroocellatus Gunth., 382, 387.
nigro-ocellatus Gunth., 387.
reinhardtii Lütk., 418.
spinosus Steind., 405.
(Dasyscopelus) spinosus Lütk., 405.
(Rhinoscopelus) andreæ Lütk., 383.
Selery, 235.
Sial, 89.
Sibuyas, mura, 235, 242.
Sidág, 78.
Siduń, 77.
Siko, 78.
Sili, 237.
Silíb, 80.
Sílug, 87.
Sinay, 77.
Sineguwelas, 242.
Singkamas, 239.
Smilogobius—Continued.
Sinigang, 234.
Síńit, 77, 78, 79, 80, 81, 82, 91.
Sinulpít, 89.
sipań, 101.
Sipí, 94.
Sisilúzan, 87.
Sison ammi Linn., 332.
Sitaw, 237.
Sitsaro, 237, 241, 242.
Síxây, 91, 99.
Sixídan, 78.
Siyú, 78.
Sloanea Linn., 328.
sigun (Blm.) Schum., 328.
sigun Koord., 328.
sigun Koord. and Val., 328.
sigun Gap., 328.
Smilogobius, 183.
cinctus Herre, 183, 187.
inexplicatus Herre, 183, 187.
obliquus Herre, 183, 188.
singapurensis Herre, 183, 188.
Sóba, 79.
Sókar, 83.
Sorbus aucuparia, 315.
Sosoktán, 81.
Sparganophorus vaillant Cr., 336.
vaillantii Cr., 336.
Sphagerbranchus misolensis Web., and de Beauf., 10.
Spinach, Baguio, 235.
Spinaka, 242.
Sporadipus (Colpochirota) ualensis Br., 215.
Stichopidae Br., 110, 123.
Stichopus Br., 110, 123.
ananas Mit., 126.
ananas Semp., 126.
ananas Sluit., 126.
ananas Theel, 126.
godeffroyi Semp., 125.
godeffroyi var. b. Semp., 125.
godeffroyi var. pygmæus Semp., 125.
horrens Dom., 125.
horrens Sel., 110, 125.
tropicalis, Fish., 125.
variegatus Clk., 123.
variegatus Dom., 123.
variegatus Semp., 110, 123, 124, 125.
variegatus Semp. var. hermanni Clk., 124.
variegatus Semp. var. hermanni Semp., 110, 123, 124.
Stigmarota jangomas Lour., 331.
Strachia heterospila Wal., 310.
Struchium Browne, 336.
sparganophorum (Linn.) Kunt., 336.
Styringomyia, 23, 24.
nipponensis Alex., 305.
Suha, 232, 242.
Synapta Esch., 110, 126.
astrolabi Held, 127.
baselii Jaeg., 127.

Synapta—Continued.
beselii, Semp., 127.
beselii Tenn.-Woods, 127.
beselii Theel, 127.
kallipeplos Sluit., 128.
kefersteinii Sel., 128.
maculata (Cham. and Eysen.), 110, 119, 126, 128.
maculata Clk., 127.
maculata Dom., 127.
maculata Jaeg., 127.
mammillosa Esch., 126.
oceanica Jaeg., 127.
Synaptidae Osterg., 110, 126.
Synaptula kefersteinii Fish., 128.

T

Tabáyug, 101.
Tabúñān, 84, 85.
Tadáwag, 83.
Taddó, 89, 93.
Takád, 86.
Takilāy, 78, 81, 82.
Takilāy-post, 81.
Takkag (ligodium sp.) 101.
Taláb, 89.
Talabáwan, 82, 84.
Talákub, 92, 93.
Talamánud, 102.
Tálan, 96.
Talaxátag, 86.
Talaxatag-laths, 86, 87.
Talong, 237.
Taluñásiñ, 80.
Tambabay, 93.
Tampaníki, 93, 95.
Tamúyoñ, 70, 81, 86.
Tañade, 84.
Tanyptera, 23.
angustistyla Alex., 142.
jozana Alex., 43.
jozana Esaki, et al., 43.
jozana (Mat.), 32.
jozana fumibasis Alex., 44.
jozana (Mat.), 43.
perangusta, 141.
macro Loew, 30.
Tápi, 78, 80.
Tápi-beam, 80, 86, 87.
Tarákip, 78, 80.
Ṭatá, 89.
Taxaligdá, 95.
Taxan, 87.
Tekat, 230.
TEMPLA, MAGDALENA ALDE. Preliminary studies on the utilization of copra meal for plastics, 1.
Thalassogobius Herre, 182, *183.*
corallinus Herre, 182, *183.*
Thaumastoptera, 23.
Thelenota Br., 110, 126.
Thelenota Br., 110, 126.
ananas, Clk., 126.
Thelenota—Continued.
ananas Dom., 126.
ananas (Jaeg), 110, 122, 126.
Thrypticomyia arcuata Alex., 162.
Tipula, 23, 24.
acifera Alex., 268.
aino Alex., 272.
aino Esaki, et al., 272.
aino Shiraki, 272.
asio Alex., 156.
coquilletti Enderl., 44.
coquilletti Esaki, et al., 44.
cornicina Linn., 145.
dischroistigma Alex., 51.
ecaudata Alex., 268, 271, 272.
fumifasciata Brun., 150.
futilis Alex., 51.
japonica, 24.
joana Alex., 274.
kuzuensis Alex., 274.
kuzuensis Esaki, et al., 274.
longicauda, 25.
manca Alex., 281.
mikado West., 39.
nipponensis Alex., 150.
nipponensis Esaki, et al., 150.
nova Walk., 150.
nubifera Coq., 44.
parva, 24.
pendula Alex., 53.
plagiotoma Alex., 281.
quadrifasciata Mat., 31.
ligula Alex.), 270.
serridens Alex., 50.
serricauda Alex., 156.
seticellula Alex., 53.
tetracantha Alex., 273.
tokionis Alex., 50.
yamata Esaki, et al., 50.
yusou Alex., 281.
(Acutipula), 22.
(Acutipula) bubo Alex., 32.
(Acutipula) *bulbifera, 151.*
(Acutipula) gemma, 151, *152.*
(Acutipula) kuzuensis Alex., 32, 154, 274.
(Acutipula) tokionis Alex., 50, 154.
(Acutipula) turbida Alex., 32.
(Arctotipula) *hirticula, 154.*
(Arctotipula) kincaidi Alex., 155.
(Arctotipula) salicetorum Sieb., 155.
(Formotipula), 31.
(Indotipula), 23.
(Indotipula) tetracantha Alex., 273.
(Indotipula) yamata Alex., 32, 50.
(Lunatipula) manca Alex., 281.
(Lunatipula) *naviculifer breviscapha, 53,* 54, 55.
(Lunatipula) pendula Alex., 53.
(Lunatipula) plagiotoma Alex., 281.
(Lunatipula) shogun Alex., 55.
(Nippotipula) coquilletti Alex., 44.
(Nippotipula) coquilletti Endrl., 32, 44.

Tipula—Continued.
(Oreomyza), 23.
(Oreomyza) automna Alex., 274.
(Oreomyza) dichroistigma Alex., 51.
(Oreomyza) flavocostalis Alex., 274.
(Oreomyza) futulis Alex., 51.
(Oreomyza) *imanoansis, 274.*
(Oreomyza) *imitator,* 51.
(Oreomyza) ishiharana Alex., 276.
(Oreomyza) *ligulalata, 277.*
(Oreomyza) matsumuriana Alex., 53.
(Oreomyza) *melanonotalis, 279.*
(Oreomyza) politostriata Alex., 277, 279.
(Oreomyza) pollex Alex., 53.
(Oreomyza) quadrifasciata Mat., 31, 32, 277.
(Oreomyza) seticellula Alex., 53.
(Oreomyza) taikum Alex., 32.
(Oreomyza) yusou Alex., 274, 276, 281.
(Schummelia) acifera Alex., 268.
(Schummelia) ecaudata Alex., 268.
(Schummelia) *ishizuchiana, 269.*
(Schummelia) nipponensis Alex., 32, 150.
(Schummelia) querula Alex., 272.
(Schummelia) *saragaminensis, 270.*
(Schummelia) variicornis Schum. (lati-
(Tipula) moiwana Mat., 31, 32.
(Tipulodina), 23.
(Tipulodina) joana Alex., 274.
(Trichotipula) politonigra Alex., 280.
(Vestiplex) 23.
(Vestiplex) asio Alex., 156.
(Vestiplex) serricauda Alex., 156.
(Vestiplex) serridens Alex., 50.
(Yamatotipula) sina Alex., 29, 32, 272.
(Yamatotipula) brevifurcata Alex., 48.
(Yamatotipula) catawbiana Alex., 48.
(Yamatotipula) iroquois Alex., 48.
(Yamatotipula) nova Alex., 150.
(Yamatotipula) latemarginata Alex., 32, 272.
(Yamatotipula) *misabana, 48.*
(Yamatotipula) nephophila Alex., 48.
(Yamatotipula) nipponensis Alex., 32.
(Yamatotipula) nova Walker, 31, 32.
(Yamatotipula) patagiata Alex., 50.
(Yamatotipula) sempiterna Alex., 48.
(Yamatotipula) tsurugiana, 50.
Tipulinae, 23, 141, 263.
Tobtóbo, 78.
Toge, 239, 240, 242.
Togkár, 92.
Togotipula pulverosa Mat., 31, 38.
Toldóg, 78, 79, 80, 86.
Tólug, 90.
Toñtoñ, 99.
Torulopsis utilis, 240.
Trentepohlia, 23, 24.
Trepang ananas Jaeg., 126.
Tricyphona, 59.
kirisimensis Alex., 59.
Tricyphona—Continued.
insulana Alex., 59.
optabilis Alex., 290.
pectinata Alex., 59.
seticauda Alex., 61.
yakushimana Alex., 290.
Tridax Linn., 337.
procumbens Linn., 337.
Triogma, 23.
kuwanai (Alex.), 32, 56.
kuwanai Esaki, et al., 56.
kuwanai limbinervis, 56.
Tropicoris basnini Osh., 314.
metalliferas Mot., 314.
metallifer Stål, 314.
rufipes Baerengs., 314.
rufipes Coub., 315.
rufipes Lieb., 315.
rufipes Mul. and Rey, 314.
Tsiko, 232.
TUASON, ANGELITA M., and AURELIO O. CRUZ, Composition of para-rubber-seed oil, 341.
Túbal, 99.
Tugây, 89.
Tugkál, 89.
Túkid, 90.
Tupláy, 101.
Túxây, 89.

U

Udonga martana, 313.
spinidens Dist., 313.
spinidens Tang., 313.
Ula, 23.
cincta Alex., 63.
(Ula) cincta Alex., 63.
Ulomorpha, 23, 24.
Ulmus, 315.
Ulomorpha nigricolor Alex., 68.
Umbelliferae, 332.
Unág, 78.
Unsoy, 241, 242.
Upo, 238.
Uppó, 91, 92, 94.
Upprís, 99.
Uray, 235, 241.
Uwáy, 86.

V

Vaimosa fusca Herre, 13.
layia Herre, *13.*
Valenciennea Blk., 349, 369, 370.
helsdingeni Blk., 369.
longipinnis (Benn.), 369, 370.
muralis (Quoy and Gaim.), 369, 370.
sexguttata Blk., 370.
strigata (Brusso.), 369.
VANOVERBERGH, MORICE. Isneg buildings, 77.
Vicia Linn., 328.
angustifolia Roth., 328.
sativa Bak., 328.

Vicia—Continued.
sativa Linn., 328.
sativa Linn. var. angustifolia Gaud., 328.
Vireosa Jord. and Snyd., 350, 373.
hanæ Jord. and Snyd., 373.

W

Wakiyus *ablani* Herre, *12*.
Wansuy, 235.
Wongbok, 234.

X

Xabáwān, 99.
Xagíyánan, 81, 93.
Xálut, 86.
Xamrút, 100.
Xassarán, 82, 86.
Xawan, 95.
Xiphusa jozana Alex., 43.
Xiphusa jozana Mat., 30.
Xisád, 88.
Xitáp, 88.

Y

Yamatotipula nohirae Mat., 31, 150.
YAPTINCHAY, CESAR, *see* INTENGAN ALEJO, CONCEPCION, YAPTINCHAY, POBRE, SALUD, and MANALO.
YUTUC, L. M. Physaloptera pseudopræputialis n. sp.—a stomach worm of the cat (Nematoda: Physalopterinæ), 221.

Z

Zebreleotris Herre, 189, *191*, 347, 356.
faciata Herre, *191*, 357.

THE PHILIPPINE JOURNAL OF SCIENCE

VOLUME 82

JANUARY TO DECEMBER, 1953

WITH 21 PLATES AND 22 TEXT FIGURES

MANILA
BUREAU OF PRINTING
1954

36736

EDITORIAL BOARD

JOAQUIN MARAÑON, D.Sc., *Editor*

EDUARDO QUISUMBING, Ph.D., *Associate Editor*

CONTRIBUTING EDITORS

Chemistry

MANUEL L. ROXAS, Ph.D.; F. T. ADRIANO, Ph.D.; R. H. AGUILAR, Ch.E.
PATROCINIO VALENZUELA, Ph.D.; MARCOS M. ALICANTE, Ph.D.
A. J. HERMANO, D.Sc.; FELIX V. ESPINO., Ch.E.

Geology

V. ELICAÑO, B.S.; ANTONIO D. ALVIR, Ph.D.; JOSE FELICIANO, Ph.D.

Experimental Medicine

DANIEL DE LA PAZ, M.D.; ARTURO GARCIA, M.D.; ONOFRE GARCIA, M.D.
CRISTOBAL MANALANG, M.D.; H. W. WADE, M.D.
WALFRIDO DE LEON, M.D.

Clinical Medicine

ANTONIO SISON, M.D.; AGERICO B. M. SISON, M.D.
LIBORIO GOMEZ, M.D., Ph.D.; H. LARA, M.D.
JOSE RODRIGUEZ, M.D.; CARMELO REYES, M.D.

Botany

ELMER D. MERRILL, D.Sc.; E. B. COPELAND, Ph.D.; A. F. FISCHER, C.E., M.F.
T. G. FAJARDO, Ph.D.; NICANOR G. TEODORO, Ph.D.
FELICIANO M. CLARA, Ph.D.; NEMESIO B. MENDIOLA, Ph.D.

Zoölogy

LEOPOLDO B. UICHANCO, D.Sc.; DEOGRACIAS V. VILLADOLID, Ph.D.
HERACLIO R. MONTALBAN, M.A.; GONZALO MERINO, Ph.D.
CANUTO G. MANUEL, D.Sc.; MANUEL D. SUMULONG, M.S., D.V.M.
LOPE M. YUTUC, D.V.M.; FAUSTINO Q. OTANES, M.S.
LEOPOLDO S. CLEMENTE, Ph.D.

Anthropology

H. O. BEYER, M.A.; RICARDO E. GALANG, M.A.

CONTENTS

No. 1, March, 1953

[Issued November 14, 1953]

Page

TEMPLA, MAGDALENA ALDE. Preliminary studies on the utilization of copra meal for plastics 1

One text figure.

HERRE, ALBERT W. C. T. Eight additions to the Philippine fish fauna, including three new species 9

PAUL, ASOKA KUMAR, and ROBINDRA DATTA. On the morphology and development of the female gametophyte in *Oryza coarctata* Roxb. 15

One plate.

ALEXANDER, CHARLES P. Records and descriptions of Japanese Tipulidæ (Diptera), Part I. The crane-flies of Shikoku, I..... 21

Two plates and three text figures,

VANOVERBERGH, MORICE. Isneg buildings 77

Four plates.

No. 2, June, 1953

[Issued November 14, 1953]

DOMANTAY, JOSE S. Littoral holothurians from Zamboanga and vicinity 109

DOMANTAY, JOSE S. A brief summary of the Pacific and Atlantic Holothurioidea of the Allan Hancock foundation collections..... 133

ALEXANDER, CHARLES P. Records and descriptions of Japanese Tipulidæ (Diptera), Part II. The crane-flies of Shikoku, II.... 141

Four plates.

HERRE, ALBERT W. C. T. Tropical Pacific gobies with vomerine teeth 181

HERRE, ALBERT W. C. T. The tropical Pacific Eleotridæ with vomerine teeth with descriptions of two new genera and two new species from the Marshall Islands 189

HERRE, ALBERT W. C. T. A new species of Gnatholepis with a key to the tropical Pacific species 193

KOHNO, MRS. MITSUKO. New species of Capnidæ (Plecoptera) from Japan 199

Three text figures.

BOOKS 207

No. 3, September, 1953

[Issued March 4, 1953]

AGUILAR, RAFAEL H. The composition and physical properties of some Philippine volcanic tuffs 209

One plate.

YUTUC, L. M. *Physaloptera pseudophraeputialis* n. sp.–A stomach worm of the cat (Nematoda: Physalopterinæ) 221

INTENGAN, CARMEN LL., LEON G. ALEJO, ISABEL CONCEPCION, CESAR YAPTINCHAY, VICTORIA L. POBRE, ROSITA D. SALUD, and JOSEFINA D. MANALO. Composition of Philippine foods, I 227

OEHME–LEONHARDT, BRIGITTE G. A new Philippine species of *Nosodendron* 253

Three text figures.

ALEXANDER, CHARLES P. Records and descriptions of Japanese Tipulidæ (Diptera), Part III. The crane-flies of Shikoku, III 263

Five Plates.

HOFFMANN, WILLIAM E. Third supplement to a catalogue of Scutelleroidea 309

BOOKS 319

No. 4, December, 1953

[Issued June 15, 1954]

MERRILL, E. D., and EDUARDO QUISUMBING. New Philippine plants, II 323

Five plates.

TUASON, ANGELITA M., and AURELIO O. CRUZ. Composition of para-rubber-seed oil 341

HERRE, ALBERT W. C. T. The eleotrid gobies of the Philippines and adjacent regions 345

SARENAS, ARTEMIO M. A revision of the Philippine Myctophidæ..... 375

Two plates and twelve text figures.

THE PHILIPPINE JOURNAL OF SCIENCE

Published by the Institute of Science and Technology
(Formerly Bureau of Science)

JOAQUIN MARAÑON, D.Sc., *Editor*

EDUARDO QUISUMBING, Ph.D., *Associate Editor*

CONTRIBUTING EDITORS

Chemistry

MANUEL L. ROXAS, Ph.D.; F. T. ADRIANO, Ph. D.; R. H. AGUILAR, Ch.E.
PATROCINIO VALENZUELA, Ph.D.; MARCOS M. ALICANTE, Ph.D.
A. J. HERMANO, D.Sc.; FELIX V. ESPINO, Ch.E.

Geology

V. ELICAÑO, B.S.; ANTONIO D. ALVIR, Ph.D.; JOSE FELICIANO, Ph.D.

Experimental Medicine

DANIEL DE LA PAZ, M.D.; ARTURO GARCIA, M.D.; ONOFRE GARCIA, M.D.
CRISTOBAL MANALANG, M.D.; H. W. WADE, M.D.
WALFRIDO DE LEON, M.D.

Clinical Medicine

ANTONIO SISON, M.D.; AGERICO B. M. SISON, M.D.
LIBORIO GOMEZ, M.D., Ph.D.; H. LARA, M.D.
JOSE RODRIGUEZ, M.D.; CARMELO REYES, M.D.

Botany

ELMER D. MERRILL, D.Sc.; E. B. COPELAND, Ph.D.; A. F. FISCHER, C.E., M.F.
T. G. FAJARDO, Ph.D.; NICANOR G. TEODORO, Ph.D.
FELICIANO M. CLARA, Ph.D.; NEMESIO B. MENDIOLA, Ph.D.

Zoölogy

LEOPOLDO B. UICHANCO, D.Sc.; DEOGRACIAS V. VILLADOLID, Ph.D.
HERACLIO R. MONTALBAN, M.A.; GONZALO MERINO, Ph.D.
CANUTO G. MANUEL, D.Sc.; MANUEL D. SUMULONG, M.S., D.V.M.
LOPE M. YUTUC, D.V.M.; FAUSTINO Q. OTANES, M.S.
LEOPOLDO S. CLEMENTE, Ph.D.

Anthropology

H. O. BEYER, M.A.; RICARDO E. GALANG, M.A.

CONTENTS

	Page
MERRILL, E. D., and EDUARDO QUISUMBING. New Philippine plants, II	323
TUASON, ANGELITA M., AND AURELIO O. CRUZ. Composition of para-rubber-seed oil	341
HERRE, ALBERT W. C. T. The eleotrid gobies of the Philippines and adjacent regions	345
SARENAS, ARTEMIO M. A revision of the Philippine Myctophidæ	375
ERRATA	429
INDEX	431

36736